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Lampiran 1. Titik kesetimbangan bebas penyakit dan endemik model penyebaran COVID-19

```
> restart:
> with(linalg):
> P1 := μ + γ·r - (1 - ρ1)·(1 - ρ2)·β·s·(c + u) - μ·s
```

$$P1 := \mu + \gamma r - (1-\rho 1)(1-\rho 2)\beta s(c+u) - \mu s$$

```
> P2 := (1 - ρ1)·(1 - ρ2)·β·s·(c + u) - (δ + σ + μ)·c
```

$$P2 := (1-\rho 1)(1-\rho 2)\beta s(c+u) - (\delta+\sigma+\mu)c$$

```
> P3 := δ_1·c - (q·α + (1 - q)·ω + μ)·p
```

$$P3 := \delta\_1 c - (q\alpha + (1-q)\omega + \mu)p$$

```
> P4 := (1 - ρ1)·δ_2·c - (ω + μ)·u
```

$$P4 := (1-\rho 1)\delta\_2 c - (\omega+\mu)u$$

```
> P5 := σ·c + q·α·p - (μ + γ)·r
```

$$P5 := \sigma c + q\alpha p - (\mu+\gamma)r$$

```
> fixedpoint := solve({P1, P2, P3, P4, P5}, {s, c, p, u, r})
```

$$fixedpoint := \{c=0, p=0, r=0, s=1, u=0\}, \{c = (\mu(-\alpha\beta\gamma q\rho 1^2\rho 2\delta\_2 - \alpha\beta\mu q\rho 1^2\rho 2\delta\_2 + \beta\gamma\omega q\rho 1^2\rho 2\delta\_2 + \beta\mu\omega q\rho 1^2\rho 2\delta\_2 + \alpha\beta\gamma\omega q\rho 1\rho 2 + \alpha\beta\gamma q\rho 1^2\delta\_2$$

$$+ 2\alpha\beta\gamma q\rho 1\rho 2\delta\_2 + \alpha\beta\mu\omega q\rho 1\rho 2 + \alpha\beta\mu q\rho 1^2\delta\_2 + 2\alpha\beta\mu q\rho 1\rho 2\delta\_2 - \beta\gamma\omega^2 q\rho 1\rho 2 - \beta\gamma\omega q\rho 1^2\delta\_2 - 2\beta\gamma\omega q\rho 1\rho 2\delta\_2 - \beta\gamma\omega\rho 1^2\rho 2\delta\_2 - \beta\mu\omega^2 q\rho 1\rho 2$$

$$- \beta\mu\omega q\rho 1^2\delta\_2 - 2\beta\mu\omega q\rho 1\rho 2\delta\_2 - \beta\mu\omega\rho 1^2\rho 2\delta\_2 - \alpha\beta\gamma\omega q\rho 1 - \alpha\beta\gamma\omega q\rho 2 - 2\alpha\beta\gamma q\rho 1\delta\_2 - \alpha\beta\gamma q\rho 2\delta\_2 - \alpha\beta\mu\omega q\rho 1 - \alpha\beta\mu\omega q\rho 2 - 2\alpha\beta\mu q\rho 1\delta\_2$$

$$- \alpha\beta\mu q\rho 2\delta\_2 + \beta\gamma\omega^2 q\rho 1 + \beta\gamma\omega^2 q\rho 2 + \beta\gamma\omega^2\rho 1\rho 2 + 2\beta\gamma\omega q\rho 1\delta\_2 + \beta\gamma\omega q\rho 2\delta\_2 + \beta\gamma\omega\rho 1^2\delta\_2 + 2\beta\gamma\omega\rho 1\rho 2\delta\_2 + \beta\mu\omega^2 q\rho 1 + \beta\mu\omega^2 q\rho 2 + \beta\mu\omega^2\rho 1\rho 2$$

$$+ 2\beta\mu\omega q\rho 1\delta\_2 + \beta\mu\omega q\rho 2\delta\_2 + \beta\mu\omega\rho 1^2\delta\_2 + 2\beta\mu\omega\rho 1\rho 2\delta\_2 + \alpha\beta\gamma\omega q + \alpha\beta\gamma q\delta\_2 + \alpha\beta\mu\omega q + \alpha\beta\mu q\delta\_2 - \alpha\delta\gamma\omega q - \alpha\delta\mu\omega q - \alpha\gamma\mu\omega q - \alpha\gamma\omega q\sigma$$

$$- \alpha\mu^2\omega q - \alpha\mu\omega q\sigma - \beta\gamma\omega^2 q - \beta\gamma\omega^2\rho 1 - \beta\gamma\omega^2\rho 2 - \beta\gamma\omega q\delta\_2 - 2\beta\gamma\omega\rho 1\delta\_2 - \beta\gamma\omega\rho 2\delta\_2 - \beta\mu\omega^2 q - \beta\mu\omega^2\rho 1 - \beta\mu\omega^2\rho 2 - \beta\mu\omega q\delta\_2 - 2\beta\mu\omega\rho 1\delta\_2$$

$$- \beta\mu\omega\rho 2\delta\_2 + \delta\gamma\omega^2 q + \delta\mu\omega^2 q + \gamma\mu\omega^2 q + \gamma\omega^2 q\sigma + \mu^2\omega^2 q + \mu\omega^2 q\sigma + \beta\gamma\omega^2 + \beta\gamma\omega\delta\_2 + \beta\mu\omega^2 + \beta\mu\omega\delta\_2 - \delta\gamma\omega^2 - \delta\mu\omega^2 - \gamma\mu\omega^2 - \gamma\omega^2\sigma - \mu^2\omega^2$$

$$- \mu\omega^2\sigma))/(\beta(-\alpha\delta\gamma q\rho 1^2\rho 2\delta\_2 - \alpha\delta\mu q\rho 1^2\rho 2\delta\_2 - \alpha\gamma\mu q\rho 1^2\rho 2\delta\_2 + \alpha\gamma q\rho 1^2\rho 2\delta\_1\delta\_2 - \alpha\mu^2 q\rho 1^2\rho 2\delta\_2 - \alpha\mu q\rho 1^2\rho 2\sigma\delta\_2 + \delta\gamma\omega q\rho 1^2\rho 2\delta\_2$$

$$+ \delta\mu\omega q\rho 1^2\rho 2\delta\_2 + \gamma\mu\omega q\rho 1^2\rho 2\delta\_2 + \mu^2\omega q\rho 1^2\rho 2\delta\_2 + \mu\omega q\rho 1^2\rho 2\sigma\delta\_2 + \alpha\delta\gamma\omega q\rho 1\rho 2 + \alpha\delta\gamma q\rho 1^2\delta\_2 + 2\alpha\delta\gamma q\rho 1\rho 2\delta\_2 + \alpha\delta\mu\omega q\rho 1\rho 2$$

$$+ \alpha\delta\mu q\rho 1^2\delta\_2 + 2\alpha\delta\mu q\rho 1\rho 2\delta\_2 + \alpha\gamma\mu\omega q\rho 1\rho 2 + \alpha\gamma\mu q\rho 1^2\delta\_2 + 2\alpha\gamma\mu q\rho 1\rho 2\delta\_2 - \alpha\gamma\omega q\rho 1\rho 2\delta\_1 - \alpha\gamma q\rho 1^2\delta\_1\delta\_2 - 2\alpha\gamma q\rho 1\rho 2\delta\_1\delta\_2$$

$$+ \alpha\mu^2\omega q\rho 1\rho 2 + \alpha\mu^2 q\rho 1^2\delta\_2 + 2\alpha\mu^2 q\rho 1\rho 2\delta\_2 + \alpha\mu\omega q\rho 1\rho 2\sigma + \alpha\mu q\rho 1^2\sigma\delta\_2 + 2\alpha\mu q\rho 1\rho 2\sigma\delta\_2 - \delta\gamma\omega^2 q\rho 1\rho 2 - \delta\gamma\omega q\rho 1^2\delta\_2 - 2\delta\gamma\omega q\rho 1\rho 2\delta\_2$$

$$- \delta\gamma\omega\rho 1^2\rho 2\delta\_2 - \delta\mu\omega^2 q\rho 1\rho 2 - \delta\mu\omega q\rho 1^2\delta\_2 - 2\delta\mu\omega q\rho 1\rho 2\delta\_2 - \delta\mu\omega\rho 1^2\rho 2\delta\_2 - \gamma\mu\omega^2 q\rho 1\rho 2 - \gamma\mu\omega q\rho 1^2\delta\_2 - 2\gamma\mu\omega q\rho 1\rho 2\delta\_2 - \gamma\mu\omega\rho 1^2\rho 2\delta\_2$$

$$- \mu^2\omega^2 q\rho 1\rho 2 - \mu^2\omega q\rho 1^2\delta\_2 - 2\mu^2\omega q\rho 1\rho 2\delta\_2 - \mu^2\omega\rho 1^2\rho 2\delta\_2 - \mu\omega^2 q\rho 1\rho 2\sigma - \mu\omega q\rho 1^2\sigma\delta\_2 - 2\mu\omega q\rho 1\rho 2\sigma\delta\_2 - \mu\omega\rho 1^2\rho 2\sigma\delta\_2 - \alpha\delta\gamma\omega q\rho 1$$

$$-\alpha\delta\gamma\omega q\rho 2-2\alpha\delta\gamma q\rho 1\delta\_2-\alpha\delta\gamma q\rho 2\delta\_2-\alpha\delta\mu\omega q\rho 1-\alpha\delta\mu\omega q\rho 2-2\alpha\delta\mu q\rho 1\delta\_2-\alpha\delta\mu q\rho 2\delta\_2-\alpha\gamma\mu\omega q\rho 1-\alpha\gamma\mu\omega q\rho 2-2\alpha\gamma\mu q\rho 1\delta\_2$$

$$-\alpha\gamma\mu q\rho 2\delta\_2+\alpha\gamma\omega q\rho 1\delta\_1+\alpha\gamma\omega q\rho 2\delta\_1+2\alpha\gamma q\rho 1\delta\_1\delta\_2+\alpha\gamma q\rho 2\delta\_1\delta\_2-\alpha\mu^2\omega q\rho 1-\alpha\mu^2\omega q\rho 2-2\alpha\mu^2 q\rho 1\delta\_2-\alpha\mu^2 q\rho 2\delta\_2-\alpha\mu\omega q\rho 1\sigma$$

$$-\alpha\mu\omega q\rho 2\sigma-2\alpha\mu q\rho 1\sigma\delta\_2-\alpha\mu q\rho 2\sigma\delta\_2+\delta\gamma\omega^2 q\rho 1+\delta\gamma\omega^2 q\rho 2+\delta\gamma\omega^2\rho 1\rho 2+2\delta\gamma\omega q\rho 1\delta\_2+\delta\gamma\omega q\rho 2\delta\_2+\delta\gamma\omega\rho 1^2\delta\_2+2\delta\gamma\omega\rho 1\rho 2\delta\_2$$

$$+\delta\mu\omega^2 q\rho 1+\delta\mu\omega^2 q\rho 2+\delta\mu\omega^2\rho 1\rho 2+2\delta\mu\omega q\rho 1\delta\_2+\delta\mu\omega q\rho 2\delta\_2+\delta\mu\omega\rho 1^2\delta\_2+2\delta\mu\omega\rho 1\rho 2\delta\_2+\gamma\mu\omega^2 q\rho 1+\gamma\mu\omega^2 q\rho 2+\gamma\mu\omega^2\rho 1\rho 2$$

$$+2\gamma\mu\omega q\rho 1\delta\_2+\gamma\mu\omega q\rho 2\delta\_2+\gamma\mu\omega\rho 1^2\delta\_2+2\gamma\mu\omega\rho 1\rho 2\delta\_2+\mu^2\omega^2 q\rho 1+\mu^2\omega^2 q\rho 2+\mu^2\omega^2\rho 1\rho 2+2\mu^2\omega q\rho 1\delta\_2+\mu^2\omega q\rho 2\delta\_2+\mu^2\omega\rho 1^2\delta\_2$$

$$+2\mu^2\omega\rho 1\rho 2\delta\_2+\mu\omega^2 q\rho 1\sigma+\mu\omega^2 q\rho 2\sigma+\mu\omega^2\rho 1\rho 2\sigma+2\mu\omega q\rho 1\sigma\delta\_2+\mu\omega q\rho 2\sigma\delta\_2+\mu\omega\rho 1^2\sigma\delta\_2+2\mu\omega\rho 1\rho 2\sigma\delta\_2+\alpha\delta\gamma\omega q+\alpha\delta\gamma q\delta\_2+\alpha\delta\mu\omega q$$

$$+\alpha\delta\mu q\delta\_2+\alpha\gamma\mu\omega q+\alpha\gamma\mu q\delta\_2-\alpha\gamma\omega q\delta\_1-\alpha\gamma q\delta\_1\delta\_2+\alpha\mu^2\omega q+\alpha\mu^2 q\delta\_2+\alpha\mu\omega q\sigma+\alpha\mu q\sigma\delta\_2-\delta\gamma\omega^2 q-\delta\gamma\omega^2\rho 1-\delta\gamma\omega^2\rho 2-\delta\gamma\omega q\delta\_2$$

$$-2\delta\gamma\omega\rho 1\delta\_2-\delta\gamma\omega\rho 2\delta\_2-\delta\mu\omega^2 q-\delta\mu\omega^2\rho 1-\delta\mu\omega^2\rho 2-\delta\mu\omega q\delta\_2-2\delta\mu\omega\rho 1\delta\_2-\delta\mu\omega\rho 2\delta\_2-\gamma\mu\omega^2 q-\gamma\mu\omega^2\rho 1-\gamma\mu\omega^2\rho 2-\gamma\mu\omega q\delta\_2$$

$$-2\gamma\mu\omega\rho 1\delta\_2-\gamma\mu\omega\rho 2\delta\_2-\mu^2\omega^2 q-\mu^2\omega^2\rho 1-\mu^2\omega^2\rho 2-\mu^2\omega q\delta\_2-2\mu^2\omega\rho 1\delta\_2-\mu^2\omega\rho 2\delta\_2-\mu\omega^2 q\sigma-\mu\omega^2\rho 1\sigma-\mu\omega^2\rho 2\sigma-\mu\omega q\sigma\delta\_2$$

$$-2\mu\omega\rho 1\sigma\delta\_2-\mu\omega\rho 2\sigma\delta\_2+\delta\gamma\omega^2+\delta\gamma\omega\delta\_2+\delta\mu\omega^2+\delta\mu\omega\delta\_2+\gamma\mu\omega^2+\gamma\mu\omega\delta\_2+\mu^2\omega^2+\mu^2\omega\delta\_2+\mu\omega^2\sigma+\mu\omega\sigma\delta\_2)),p=((-\beta\gamma\rho 1^2\rho 2\delta\_2$$

$$-\beta\mu\rho 1^2\rho 2\delta\_2+\beta\gamma\omega\rho 1\rho 2+\beta\gamma\rho 1^2\delta\_2+2\beta\gamma\rho 1\rho 2\delta\_2+\beta\mu\omega\rho 1\rho 2+\beta\mu\rho 1^2\delta\_2+2\beta\mu\rho 1\rho 2\delta\_2-\beta\gamma\omega\rho 1-\beta\gamma\omega\rho 2-2\beta\gamma\rho 1\delta\_2-\beta\gamma\rho 2\delta\_2-\beta\mu\omega\rho 1$$

$$-\beta\mu\omega\rho 2-2\beta\mu\rho 1\delta\_2-\beta\mu\rho 2\delta\_2+\beta\gamma\omega+\beta\gamma\delta\_2+\beta\mu\omega+\beta\mu\delta\_2-\delta\gamma\omega-\delta\mu\omega-\gamma\mu\omega-\gamma\omega\sigma-\mu^2\omega-\mu\omega\sigma)\delta\_1\mu)\Big/((-\rho 1^2\rho 2\delta\_2+\omega\rho 1\rho 2+\rho 1^2\delta\_2$$

$$+2\rho 1\rho 2\delta\_2-\omega\rho 1-\omega\rho 2-2\rho 1\delta\_2-\rho 2\delta\_2+\omega+\delta\_2)(\alpha\delta\gamma q+\alpha\delta\mu q+\alpha\gamma\mu q-\alpha\gamma q\delta\_1+\alpha\mu^2 q+\alpha\mu q\sigma-\delta\gamma\omega q-\delta\mu\omega q-\gamma\mu\omega q-\mu^2\omega q-\mu\omega q\sigma$$

$$+\delta\gamma\omega+\delta\mu\omega+\gamma\mu\omega+\mu^2\omega+\mu\omega\sigma)\beta),r=((-\alpha\beta q\rho 1^2\rho 2\sigma\delta\_2-\alpha\beta q\rho 1^2\rho 2\delta\_1\delta\_2+\beta\omega q\rho 1^2\rho 2\sigma\delta\_2+\alpha\beta\omega q\rho 1\rho 2\sigma+\alpha\beta\omega q\rho 1\rho 2\delta\_1$$

$$+\alpha\beta q\rho 1^2\sigma\delta\_2+\alpha\beta q\rho 1^2\delta\_1\delta\_2+2\alpha\beta q\rho 1\rho 2\sigma\delta\_2+2\alpha\beta q\rho 1\rho 2\delta\_1\delta\_2-\beta\omega^2 q\rho 1\rho 2\sigma-\beta\omega q\rho 1^2\sigma\delta\_2-2\beta\omega q\rho 1\rho 2\sigma\delta\_2-\beta\omega\rho 1^2\rho 2\sigma\delta\_2$$

$$-\alpha\beta\omega q\rho 1\sigma-\alpha\beta\omega q\rho 1\delta\_1-\alpha\beta\omega q\rho 2\sigma-\alpha\beta\omega q\rho 2\delta\_1-2\alpha\beta q\rho 1\sigma\delta\_2-2\alpha\beta q\rho 1\delta\_1\delta\_2-\alpha\beta q\rho 2\sigma\delta\_2-\alpha\beta q\rho 2\delta\_1\delta\_2+\beta\omega^2 q\rho 1\sigma+\beta\omega^2 q\rho 2\sigma$$

$$+\beta\omega^2\rho 1\rho 2\sigma+2\beta\omega q\rho 1\sigma\delta\_2+\beta\omega q\rho 2\sigma\delta\_2+\beta\omega\rho 1^2\sigma\delta\_2+2\beta\omega\rho 1\rho 2\sigma\delta\_2+\alpha\beta\omega q\sigma+\alpha\beta\omega q\delta\_1+\alpha\beta q\sigma\delta\_2+\alpha\beta q\delta\_1\delta\_2-\alpha\delta\omega q\sigma-\alpha\delta\omega q\delta\_1$$

$$-\alpha\mu\omega q\sigma-\alpha\mu\omega q\delta\_1-\alpha\omega q\sigma^2-\alpha\omega q\sigma\delta\_1-\beta\omega^2 q\sigma-\beta\omega^2\rho 1\sigma-\beta\omega^2\rho 2\sigma-\beta\omega q\sigma\delta\_2-2\beta\omega\rho 1\sigma\delta\_2-\beta\omega\rho 2\sigma\delta\_2+\delta\omega^2 q\sigma+\mu\omega^2 q\sigma+\omega^2 q\sigma^2$$

$$+\beta\omega^2\sigma+\beta\omega\sigma\delta\_2-\delta\omega^2\sigma-\mu\omega^2\sigma-\omega^2\sigma^2)\mu)\Big/\Big((-\rho1^2\rho2\delta\_2+\omega\rho1\rho2+\rho1^2\delta\_2+2\rho1\rho2\delta\_2-\omega\rho1-\omega\rho2-2\rho1\delta\_2-\rho2\delta\_2+\omega+\delta\_2)(\alpha\delta\gamma q$$

$$+\alpha\delta\mu q+\alpha\gamma\mu q-\alpha\gamma q\delta\_1+\alpha\mu^2 q+\alpha\mu q\sigma-\delta\gamma\omega q-\delta\mu\omega q-\gamma\mu\omega q-\mu^2\omega q-\mu\omega q\sigma+\delta\gamma\omega+\delta\mu\omega+\gamma\mu\omega+\mu^2\omega+\mu\omega\sigma)\beta),s$$

$$=\frac{\omega(\delta+\sigma+\mu)}{\beta(-\rho1^2\rho2\delta\_2+\omega\rho1\rho2+\rho1^2\delta\_2+2\rho1\rho2\delta\_2-\omega\rho1-\omega\rho2-2\rho1\delta\_2-\rho2\delta\_2+\omega+\delta\_2)},u=-\Big((-\alpha\beta\gamma q\rho1^2\rho2\delta\_2-\alpha\beta\mu q\rho1^2\rho2\delta\_2$$

$$+\beta\gamma\omega q\rho1^2\rho2\delta\_2+\beta\mu\omega q\rho1^2\rho2\delta\_2+\alpha\beta\gamma\omega q\rho1\rho2+\alpha\beta\gamma q\rho1^2\delta\_2+2\alpha\beta\gamma q\rho1\rho2\delta\_2+\alpha\beta\mu\omega q\rho1\rho2+\alpha\beta\mu q\rho1^2\delta\_2+2\alpha\beta\mu q\rho1\rho2\delta\_2-\beta\gamma\omega^2 q\rho1\rho2$$

$$-\beta\gamma\omega q\rho1^2\delta\_2-2\beta\gamma\omega q\rho1\rho2\delta\_2-\beta\gamma\omega\rho1^2\rho2\delta\_2-\beta\mu\omega^2 q\rho1\rho2-\beta\mu\omega q\rho1^2\delta\_2-2\beta\mu\omega q\rho1\rho2\delta\_2-\beta\mu\omega\rho1^2\rho2\delta\_2-\alpha\beta\gamma\omega q\rho1-\alpha\beta\gamma\omega q\rho2$$

$$-2\alpha\beta\gamma q\rho1\delta\_2-\alpha\beta\gamma q\rho2\delta\_2-\alpha\beta\mu\omega q\rho1-\alpha\beta\mu\omega q\rho2-2\alpha\beta\mu q\rho1\delta\_2-\alpha\beta\mu q\rho2\delta\_2+\beta\gamma\omega^2 q\rho1+\beta\gamma\omega^2 q\rho2+\beta\gamma\omega^2\rho1\rho2+2\beta\gamma\omega q\rho1\delta\_2$$

$$+\beta\gamma\omega q\rho2\delta\_2+\beta\gamma\omega\rho1^2\delta\_2+2\beta\gamma\omega\rho1\rho2\delta\_2+\beta\mu\omega^2 q\rho1+\beta\mu\omega^2 q\rho2+\beta\mu\omega^2\rho1\rho2+2\beta\mu\omega q\rho1\delta\_2+\beta\mu\omega q\rho2\delta\_2+\beta\mu\omega\rho1^2\delta\_2+2\beta\mu\omega\rho1\rho2\delta\_2$$

$$+\alpha\beta\gamma\omega q+\alpha\beta\gamma q\delta\_2+\alpha\beta\mu\omega q+\alpha\beta\mu q\delta\_2-\alpha\delta\gamma\omega q-\alpha\delta\mu\omega q-\alpha\gamma\mu\omega q-\alpha\gamma\omega q\sigma-\alpha\mu^2\omega q-\alpha\mu\omega q\sigma-\beta\gamma\omega^2 q-\beta\gamma\omega^2\rho1-\beta\gamma\omega^2\rho2-\beta\gamma\omega q\delta\_2$$

$$-2\beta\gamma\omega\rho1\delta\_2-\beta\gamma\omega\rho2\delta\_2-\beta\mu\omega^2 q-\beta\mu\omega^2\rho1-\beta\mu\omega^2\rho2-\beta\mu\omega q\delta\_2-2\beta\mu\omega\rho1\delta\_2-\beta\mu\omega\rho2\delta\_2+\delta\gamma\omega^2 q+\delta\mu\omega^2 q+\gamma\mu\omega^2 q+\gamma\omega^2 q\sigma+\mu^2\omega^2 q$$

$$+\mu\omega^2 q\sigma+\beta\gamma\omega^2+\beta\gamma\omega\delta\_2+\beta\mu\omega^2+\beta\mu\omega\delta\_2-\delta\gamma\omega^2-\delta\mu\omega^2-\gamma\mu\omega^2-\gamma\omega^2\sigma-\mu^2\omega^2-\mu\omega^2\sigma)\mu\delta\_2)\Big/\Big(\omega(-\alpha\delta\gamma q\rho1\rho2\delta\_2-\alpha\delta\mu q\rho1\rho2\delta\_2$$

$$-\alpha\gamma\mu q\rho1\rho2\delta\_2+\alpha\gamma q\rho1\rho2\delta\_1\delta\_2-\alpha\mu^2 q\rho1\rho2\delta\_2-\alpha\mu q\rho1\rho2\sigma\delta\_2+\delta\gamma\omega q\rho1\rho2\delta\_2+\delta\mu\omega q\rho1\rho2\delta\_2+\gamma\mu\omega q\rho1\rho2\delta\_2+\mu^2\omega q\rho1\rho2\delta\_2$$

$$+\mu\omega q\rho1\rho2\sigma\delta\_2+\alpha\delta\gamma\omega q\rho2+\alpha\delta\gamma q\rho1\delta\_2+\alpha\delta\gamma q\rho2\delta\_2+\alpha\delta\mu\omega q\rho2+\alpha\delta\mu q\rho1\delta\_2+\alpha\delta\mu q\rho2\delta\_2+\alpha\gamma\mu\omega q\rho2+\alpha\gamma\mu q\rho1\delta\_2+\alpha\gamma\mu q\rho2\delta\_2$$

$$-\alpha\gamma\omega q\rho2\delta\_1-\alpha\gamma q\rho1\delta\_1\delta\_2-\alpha\gamma q\rho2\delta\_1\delta\_2+\alpha\mu^2\omega q\rho2+\alpha\mu^2 q\rho1\delta\_2+\alpha\mu^2 q\rho2\delta\_2+\alpha\mu\omega q\rho2\sigma+\alpha\mu q\rho1\sigma\delta\_2+\alpha\mu q\rho2\sigma\delta\_2-\delta\gamma\omega^2 q\rho2$$

$$-\delta\gamma\omega q\rho1\delta\_2-\delta\gamma\omega q\rho2\delta\_2-\delta\gamma\omega\rho1\rho2\delta\_2-\delta\mu\omega^2 q\rho2-\delta\mu\omega q\rho1\delta\_2-\delta\mu\omega q\rho2\delta\_2-\delta\mu\omega\rho1\rho2\delta\_2-\gamma\mu\omega^2 q\rho2-\gamma\mu\omega q\rho1\delta\_2-\gamma\mu\omega q\rho2\delta\_2$$

$$-\gamma\mu\omega\rho1\rho2\delta\_2-\mu^2\omega^2 q\rho2-\mu^2\omega q\rho1\delta\_2-\mu^2\omega q\rho2\delta\_2-\mu^2\omega\rho1\rho2\delta\_2-\mu\omega^2 q\rho2\sigma-\mu\omega q\rho1\sigma\delta\_2-\mu\omega q\rho2\sigma\delta\_2-\mu\omega\rho1\rho2\sigma\delta\_2-\alpha\delta\gamma\omega q-\alpha\delta\gamma q\delta\_2$$

$$-\alpha\delta\mu\omega q-\alpha\delta\mu q\delta\_2-\alpha\gamma\mu\omega q-\alpha\gamma\mu q\delta\_2+\alpha\gamma\omega q\delta\_1+\alpha\gamma q\delta\_1\delta\_2-\alpha\mu^2\omega q-\alpha\mu^2 q\delta\_2-\alpha\mu\omega q\sigma-\alpha\mu q\sigma\delta\_2+\delta\gamma\omega^2 q+\delta\gamma\omega^2\rho2+\delta\gamma\omega q\delta\_2$$

$$+\delta\gamma\omega\rho1\delta\_2+\delta\gamma\omega\rho2\delta\_2+\delta\mu\omega^2 q+\delta\mu\omega^2\rho2+\delta\mu\omega q\delta\_2+\delta\mu\omega\rho1\delta\_2+\delta\mu\omega\rho2\delta\_2+\gamma\mu\omega^2 q+\gamma\mu\omega^2\rho2+\gamma\mu\omega q\delta\_2+\gamma\mu\omega\rho1\delta\_2+\gamma\mu\omega\rho2\delta\_2$$

$$+\mu^2\omega^2 q+\mu^2\omega^2\rho2+\mu^2\omega q\delta\_2+\mu^2\omega\rho1\delta\_2+\mu^2\omega\rho2\delta\_2+\mu\omega^2 q\sigma+\mu\omega^2\rho2\sigma+\mu\omega q\sigma\delta\_2+\mu\omega\rho1\sigma\delta\_2+\mu\omega\rho2\sigma\delta\_2-\delta\gamma\omega^2-\delta\gamma\omega\delta\_2-\delta\mu\omega^2$$

$$-\delta\mu\omega\delta\_2-\gamma\mu\omega^2-\gamma\mu\omega\delta\_2-\mu^2\omega^2-\mu^2\omega\delta\_2-\mu\omega^2\sigma-\mu\omega\sigma\delta\_2)\beta)\Big\}$$

Lampiran 2. Sintax simulasi untuk grafik populasi dengan nilai parameter pemberlakuan PSBB yang berbeda yaitu 0.08, 0.2, 0.3423, 0.6

(0,08)

```
> restart :
> with(linalg) : with(plots) : with(DEtools) :
>
```

$$\rho 1 := 0.3;\ \rho 2 := 0.08;\ \beta := 0.75;\ \delta 2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;$$
$$\delta 1 := 0.16;\ q := 0.96;\ \gamma 1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot(\omega+\mu+\delta 2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$$

```
> T11 :=
```
$$\frac{d}{dt}s(t) = \mu + \gamma 1\cdot r(t) - (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - \mu\cdot s(t)$$

```
> T21 :=
```
$$\frac{d}{dt}c(t) = (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - (\delta+\sigma+\mu)\cdot c(t)$$

```
> T3 :=
```
$$\frac{d}{dt}p(t) = \delta 1\cdot c(t) - (q\cdot\alpha + (1-q)\cdot\omega + \mu)\cdot p(t)$$

```
> T4 :=
```
$$\frac{d}{dt}u(t) = (1-\rho 1)\cdot\delta 2\cdot c(t) - (\omega+\mu)\cdot u(t)$$

```
> T5 :=
```
$$\frac{d}{dt}r(t) = \sigma\cdot c(t) + q\cdot\alpha\cdot p(t) - (\mu+\gamma 1)\cdot r(t)$$

```
>
>
#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0)
    = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.7, c(0) = 0.005, p(0) = 0.008,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)],
    method = rosenbrock, stepsize = 0.5);
>
#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490
```

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0) = 0.012, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, c(t)], method = rosenbrock, stepsize = 0.5);$$

> #c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0) = 0.015, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.006, u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)], method = rosenbrock, stepsize = 0.5);$$

>

#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.0004, r(0) = 0.004], [s(0) = 0.8, c(0) = 0.0001, p(0) = 0.0002, u(0) = 0.0001, r(0) = 0.004]], linecolor = [blue, green], arrows = medium, scene = [t, u(t)], method = rosenbrock, stepsize = 0.5);$$

> #c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..800, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.18], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.12]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)], method = rosenbrock, stepsize = 0.5);$$

(0,2)

> restart :

> with(linalg) : with(plots) : with(DEtools) :

>

$$\rho 1 := 0.3;\ \rho 2 := 0.2;\ \beta := 0.75;\ \delta 2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;\ \delta 1 := 0.16;\ q := 0.96;\ \gamma 1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot(\omega+\mu+\delta 2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$$

> $$T11 := \frac{d}{dt}s(t) = \mu + \gamma 1\cdot r(t) - (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - \mu\cdot s(t)$$

>

> $$T21 := \frac{d}{dt}c(t) = (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - (\delta+\sigma+\mu)\cdot c(t)$$

>

> $T3 := \frac{d}{dt}p(t) = \delta 1 \cdot c(t) - (q \cdot \alpha + (1-q) \cdot \omega + \mu) \cdot p(t)$

> $T4 := \frac{d}{dt}u(t) = (1-\rho 1) \cdot \delta 2 \cdot c(t) - (\omega + \mu) \cdot u(t)$

> $T5 := \frac{d}{dt}r(t) = \sigma \cdot c(t) + q \cdot \alpha \cdot p(t) - (\mu + \gamma 1) \cdot r(t)$

>

#c=0.003678126085,p=0.004838843722,r=0.07243649257,s=0.8496940088,u=0.0001612212695

>

DEplot([*T11*, *T21*, *T3*, *T4*, *T5*], [$s(t), c(t), p(t), u(t), r(t)$], $t = 0..900$, [[$s(0) = 0.9, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2$], [$s(0) = 0.8, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2$]], *linecolor* = [*blue*, *green*], *arrows* = *medium*, *scene* = [$t, s(t)$], *method* = *rosenbrock*, *stepsize* = 0.5);

>

#c=0.003678126085,p=0.004838843722,r=0.07243649257,s=0.8496940088,u=0.0001612212695

>

DEplot([*T11*, *T21*, *T3*, *T4*, *T5*], [$s(t), c(t), p(t), u(t), r(t)$], $t = 0..900$, [[$s(0) = 1, c(0) = 0.006, p(0) = 0.008, u(0) = 0.00008, r(0) = 0.02$], [$s(0) = 1, c(0) = 0.002, p(0) = 0.008, u(0) = 0.00008, r(0) = 0.02$]], *linecolor* = [*blue*, green], *arrows* = *medium*, *scene* = [$t, c(t)$], *method* = *rosenbrock*, *stepsize* = 0.5);

>

#c=0.003678126085,p=0.004838843722,r=0.07243649257,s=0.8496940088,u=0.0001612212695

>

DEplot([*T11*, *T21*, *T3*, *T4*, *T5*], [$s(t), c(t), p(t), u(t), r(t)$], $t = 0..900$, [[$s(0) = 1, c(0) = 0.006, p(0) = 0.005, u(0) = 0.00008, r(0) = 0.02$], [$s(0) = 1, c(0) = 0.002, p(0) = 0.001, u(0) = 0.00008, r(0) = 0.02$]], *linecolor* = [*blue*, *green*], *arrows* = *medium*, *scene* = [$t, p(t)$], *method* = *rosenbrock*, *stepsize* = 0.5);

>

#c=0.003678126085,p=0.004838843722,r=0.07243649257,s=0.8496940088,u=0.0001612212695

>

DEplot([*T11*, *T21*, *T3*, *T4*, *T5*], [$s(t), c(t), p(t), u(t), r(t)$], $t = 0..900$, [[$s(0) = 1, c(0) = 0.006, p(0) = 0.005, u(0) = 0.00008, r(0) = 0.02$], [$s(0) = 1, c(0) = 0.002, p(0) = 0.001, u(0) = 0.00008, r(0) = 0.02$]], *linecolor* = [*blue*, *green*], *arrows* = *medium*, *scene* = [$t, u(t)$], *method* = *rosenbrock*, *stepsize* = 0.5);

>

#c=0.003678126085,p=0.004838843722,r=0.07243649257,s=0.8496940088,u=0.0001612212695

```
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0)
    = 0.007, p(0) = 0.0002, u(0) = 0.0002, r(0) = 0.07], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002,
     u(0) = 0.0002, r(0) = 0.05]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)],
    method = rosenbrock, stepsize = 0.5);
```

(0,3423)

```
> restart :
> with(linalg) : with(plots) : with(DEtools) :
>
ρ1 := 0.3; ρ2 := 0.3423; β := 0.75; δ2 := 0.04; ω := 0.5; μ := 0.00322; σ := 0.17; δ
    := 0.2; δ1 := 0.16; q := 0.96; γ1 := 0.01; α := 0.1; R0
    := (1 − ρ1)·(1 − ρ2)·β·(ω + μ + δ2) / (δ + μ + σ)·(ω + μ)

> T11 := d/dt s(t) = μ + γ1·r(t) − (1 − ρ1)·(1 − ρ2)·β·s(t)·(c(t) + u(t)) − μ·s(t)
>
> T21 := d/dt c(t) = (1 − ρ1)·(1 − ρ2)·β·s(t)·(c(t) + u(t)) − (δ + σ + μ)·c(t)
>
> T3 := d/dt p(t) = δ1·c(t) − (q·α + (1 − q)·ω + μ)·p(t)
> T4 := d/dt u(t) = (1 − ρ1)·δ2·c(t) − (ω + μ)·u(t)
> T5 := d/dt r(t) = σ·c(t) + q·α·p(t) − (μ + γ1)·r(t)

>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 1.1, c(0)
    = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.9, c(0) = 0.005, p(0) = 0.008,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)],
    method = rosenbrock, stepsize = 0.5);

>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..300, [[s(0) = 0.8, c(0) = 0.009,
     p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.008, u(0)
    = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, c(t)], method
     = rosenbrock, stepsize = 0.5);
>
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..350, [[s(0) = 0.8, c(0)
    = 0.015, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.006,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)],
    method = rosenbrock, stepsize = 0.5);
```

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..150, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.0005, r(0) = 0.004], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00009, r(0) = 0.004]], linecolor = [blue, green], arrows = medium, scene = [t, u(t)], method = rosenbrock, stepsize = 0.5);$$

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..700, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.09]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)], method = rosenbrock, stepsize = 0.5);$$

(0,6)

> restart :
> with(linalg) : with(plots) : with(DEtools) :
>

$$\rho1 := 0.3;\ \rho2 := 0.6;\ \beta := 0.75;\ \delta2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;\ \delta1 := 0.16;\ q := 0.96;\ \gamma1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho1)\cdot(1-\rho2)\cdot\beta\cdot(\omega+\mu+\delta2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$$

> $$T11 := \frac{d}{dt}s(t) = \mu + \gamma1\cdot r(t) - (1-\rho1)\cdot(1-\rho2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - \mu\cdot s(t)$$
>
> $$T21 := \frac{d}{dt}c(t) = (1-\rho1)\cdot(1-\rho2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - (\delta+\sigma+\mu)\cdot c(t)$$
>
> $$T3 := \frac{d}{dt}p(t) = \delta1\cdot c(t) - (q\cdot\alpha + (1-q)\cdot\omega + \mu)\cdot p(t)$$
> $$T4 := \frac{d}{dt}u(t) = (1-\rho1)\cdot\delta2\cdot c(t) - (\omega+\mu)\cdot u(t)$$
> $$T5 := \frac{d}{dt}r(t) = \sigma\cdot c(t) + q\cdot\alpha\cdot p(t) - (\mu+\gamma1)\cdot r(t)$$

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..2000, [[s(0) = 1.3, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.7, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)], method = rosenbrock, stepsize = 0.5);$$

>

$$DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..60, [[s(0) = 0.8, c(0) = 0.00009, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.00005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, c(t)], method = rosenbrock, stepsize = 0.5);$$

>

```
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..100, [[s(0) = 0.8, c(0)
    = 0.015, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.006,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)],
    method = rosenbrock, stepsize = 0.5);

>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..50, [[s(0) = 0.8, c(0) = 0.007,
    p(0) = 0.0002, u(0) = 0.0004, r(0) = 0.004], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0)
    = 0.0001, r(0) = 0.004]], linecolor = [blue, green], arrows = medium, scene = [t, u(t)],
    method = rosenbrock, stepsize = 0.5);
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..700, [[s(0) = 0.8, c(0)
    = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002,
     u(0) = 0.00001, r(0) = 0.09]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)],
    method = rosenbrock, stepsize = 0.5);
```

Lampiran 3. Sintax simulasi untuk grafik populasi dengan nilai parameter interaksi antar individu yang berbeda yaitu 0.75, 0.65, 0.536, 0.3.

(0,75)

```
> restart :
> with(linalg) : with(plots) : with(DEtools) :
>
```

$$\rho 1 := 0.3;\ \rho 2 := 0.08;\ \beta := 0.75;\ \delta 2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;$$
$$\delta 1 := 0.16;\ q := 0.96;\ \gamma 1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot(\omega+\mu+\delta 2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$$

```
> T11 := d/dt s(t) = μ + γ1·r(t) - (1 − ρ1)·(1 − ρ2)·β·s(t)·(c(t) + u(t)) − μ·s(t)
>
> T21 := d/dt c(t) = (1 − ρ1)·(1 − ρ2)·β·s(t)·(c(t) + u(t)) − (δ + σ + μ)·c(t)
>
> T3 := d/dt p(t) = δ1·c(t) - (q·α + (1 − q)·ω + μ)·p(t)
> T4 := d/dt u(t) = (1 − ρ1)·δ2·c(t) − (ω + μ)·u(t)
> T5 := d/dt r(t) = σ·c(t) + q·α·p(t) - (μ + γ1)·r(t)
>
#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0)
    = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.7, c(0) = 0.005, p(0) = 0.008,
    u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)],
    method = rosenbrock, stepsize = 0.5);
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0) = 0.012,
    p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.008, u(0)
    = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, c(t)], method
    = rosenbrock, stepsize = 0.5);

>
#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0)
    = 0.015, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.006,
    u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)],
    method = rosenbrock, stepsize = 0.5);
```

>

#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.0004, r(0) = 0.004], [s(0) = 0.8, c(0) = 0.0001, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.004]], linecolor = [blue, green], arrows = medium, scene = [t, u(t)], method = rosenbrock, stepsize = 0.5);

>

>

#c=0.006015391641,p=0.007913687408,r=0.1348207693,s=0.734730511,u=0.000272143490

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.16], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.09]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)], method = rosenbrock, stepsize = 0.5);

(0,65)

> restart :

> with(linalg) : with(plots) : with(DEtools) :

>

$\rho 1 := 0.3;\ \rho 2 := 0.08;\ \beta := 0.65;\ \delta 2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;$
$\delta 1 := 0.16;\ q := 0.96;\ \gamma 1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot(\omega+\mu+\delta 2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$

> $T11 := \frac{d}{dt}s(t) = \mu + \gamma 1\cdot r(t) - (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - \mu\cdot s(t)$

>

> $T21 := \frac{d}{dt}c(t) = (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - (\delta+\sigma+\mu)\cdot c(t)$

>

> $T3 := \frac{d}{dt}p(t) = \delta 1\cdot c(t) - (q\cdot\alpha + (1-q)\cdot\omega + \mu)\cdot p(t)$

> $T4 := \frac{d}{dt}u(t) = (1-\rho 1)\cdot\delta 2\cdot c(t) - (\omega+\mu)\cdot u(t)$

> $T5 := \frac{d}{dt}r(t) = \sigma\cdot c(t) + q\cdot\alpha\cdot p(t) - (\mu+\gamma 1)\cdot r(t)$

>

#c=0.003618196198,p=0.004760001577,r=0.07109330598,s=0.8324689052,u=0.00021569650366

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..900, [[s(0) = 1, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.7, c(0) = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)], method = rosenbrock, stepsize = 0.5);

>

#c=0.003618196198,p=0.004760001577,r=0.07109330598,s=0.8324689052,u=
0.00021569650366

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0 ..900, [[s(0) = 1, c(0) = 0.006, p(0) = 0.008, u(0) = 0.00008, r(0) = 0.02], [s(0) = 1, c(0) = 0.0002, p(0) = 0.008, u(0) = 0.00008, r(0) = 0.02]], linecolor = [blue, green], arrows = medium, scene = [t, c(t)], method = rosenbrock, stepsize = 0.5);

>

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0 ..900, [[s(0) = 1, c(0) = 0.006, p(0) = 0.005, u(0) = 0.00008, r(0) = 0.02], [s(0) = 1, c(0) = 0.002, p(0) = 0.003, u(0) = 0.00008, r(0) = 0.02]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)], method = rosenbrock, stepsize = 0.5);

>

#c=0.003618196198,p=0.004760001577,r=0.07109330598,s=0.8324689052,u=
0.00021569650366

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0 ..900, [[s(0) = 1, c(0) = 0.006, p(0) = 0.005, u(0) = 0.00008, r(0) = 0.02], [s(0) = 1, c(0) = 0.002, p(0) = 0.001, u(0) = 0.00008, r(0) = 0.02]], linecolor = [blue, green], arrows = medium, scene = [t, u(t)], method = rosenbrock, stepsize = 0.5);

>

#c=0.003618196198,p=0.004760001577,r=0.07109330598,s=0.8324689052,u=
0.00021569650366

>

DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0 ..900, [[s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.0002, r(0) = 0.08], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0) = 0.0002, r(0) = 0.05]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)], method = rosenbrock, stepsize = 0.5);

(0,536)

> restart :

> with(linalg) : with(plots) : with(DEtools) :

>

$\rho 1 := 0.3;\ \rho 2 := 0.08;\ \beta := 0.536;\ \delta 2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;$
$\delta 1 := 0.16;\ q := 0.96;\ \gamma 1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot(\omega+\mu+\delta 2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$

> $T11 := \frac{d}{dt}s(t) = \mu + \gamma 1\cdot r(t) - (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - \mu\cdot s(t)$

>

> $T21 := \frac{d}{dt}c(t) = (1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot s(t)\cdot(c(t)+u(t)) - (\delta+\sigma+\mu)\cdot c(t)$

>

> $T3 := \frac{d}{dt}p(t) = \delta 1\cdot c(t) - (q\cdot\alpha + (1-q)\cdot\omega + \mu)\cdot p(t)$

> $T4 := \frac{d}{dt}u(t) = (1-\rho 1)\cdot\delta 2\cdot c(t) - (\omega+\mu)\cdot u(t)$

> $T5 := \frac{d}{dt}r(t) = \sigma\cdot c(t) + q\cdot\alpha\cdot p(t) - (\mu+\gamma 1)\cdot r(t)$

>

```
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..800, [[s(0) = 1.1, c(0)
    = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.9, c(0) = 0.005, p(0) = 0.008,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)],
    method = rosenbrock, stepsize = 0.5);
```

>

```
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..300, [[s(0) = 0.8, c(0) = 0.009,
     p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.008, u(0)
    = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, c(t)], method
     = rosenbrock, stepsize = 0.5);
```

>

```
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..350, [[s(0) = 0.8, c(0)
    = 0.015, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.006,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)],
    method = rosenbrock, stepsize = 0.5);
```

>

```
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..150, [[s(0) = 0.8, c(0)
    = 0.007, p(0) = 0.0002, u(0) = 0.0005, r(0) = 0.004], [s(0) = 0.8, c(0) = 0.007, p(0)
    = 0.0002, u(0) = 0.00009, r(0) = 0.004]], linecolor = [blue, green], arrows = medium, scene
     = [t, u(t)], method = rosenbrock, stepsize = 0.5);
```

>

```
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..700, [[s(0) = 0.8, c(0)
    = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002,
     u(0) = 0.00001, r(0) = 0.09]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)],
    method = rosenbrock, stepsize = 0.5);
```

(0,3)

> *restart* :
> *with*(*linalg*) : *with*(*plots*) : *with*(*DEtools*) :
>

$\rho 1 := 0.3;\ \rho 2 := 0.08;\ \beta := 0.3;\ \delta 2 := 0.04;\ \omega := 0.5;\ \mu := 0.00322;\ \sigma := 0.17;\ \delta := 0.2;\ \delta 1 := 0.16;\ q := 0.96;\ \gamma 1 := 0.01;\ \alpha := 0.1;\ R0 := \frac{(1-\rho 1)\cdot(1-\rho 2)\cdot\beta\cdot(\omega+\mu+\delta 2)}{(\delta+\mu+\sigma)\cdot(\omega+\mu)}$

```
> T11 := d/dt s(t) = μ + γ1·r(t) - (1 - ρ1)·(1 - ρ2)·β·s(t)·(c(t) + u(t)) - μ·s(t)
>
> T21 := d/dt c(t) = (1 - ρ1)·(1 - ρ2)·β·s(t)·(c(t) + u(t)) - (δ + σ + μ)·c(t)
>
> T3 := d/dt p(t) = δ1·c(t) - (q·α + (1 - q)·ω + μ)·p(t)
> T4 := d/dt u(t) = (1 - ρ1)·δ2·c(t) - (ω + μ)·u(t)
> T5 := d/dt r(t) = σ·c(t) + q·α·p(t) - (μ + γ1)·r(t)
>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..2000, [[s(0) = 1.3, c(0)
    = 0.005, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.7, c(0) = 0.005, p(0) = 0.008,
     u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, s(t)],
    method = rosenbrock, stepsize = 0.5);


>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..60, [[s(0) = 0.8, c(0)
    = 0.00009, p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.00005, p(0)
    = 0.008, u(0) = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t,
    c(t)], method = rosenbrock, stepsize = 0.5);


>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..80, [[s(0) = 0.8, c(0) = 0.015,
    p(0) = 0.008, u(0) = 0.0005, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.005, p(0) = 0.006, u(0)
    = 0.0005, r(0) = 0.2]], linecolor = [blue, green], arrows = medium, scene = [t, p(t)], method
     = rosenbrock, stepsize = 0.5);


>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..50, [[s(0) = 0.8, c(0) = 0.007,
    p(0) = 0.0002, u(0) = 0.0005, r(0) = 0.004], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002, u(0)
    = 0.00009, r(0) = 0.004]], linecolor = [blue, green], arrows = medium, scene = [t, u(t)],
    method = rosenbrock, stepsize = 0.5);


>
DEplot([T11, T21, T3, T4, T5], [s(t), c(t), p(t), u(t), r(t)], t = 0..700, [[s(0) = 0.8, c(0)
    = 0.007, p(0) = 0.0002, u(0) = 0.00001, r(0) = 0.2], [s(0) = 0.8, c(0) = 0.007, p(0) = 0.0002,
     u(0) = 0.00001, r(0) = 0.09]], linecolor = [blue, green], arrows = medium, scene = [t, r(t)],
    method = rosenbrock, stepsize = 0.5);
```

Lampiran 4. Sintax grafik perbandingan antara parameter pemberlakuan PSBB dan interaksi antar individu pada saat $R_0 = 1$

```
> restart :
> with(linalg) : with(plots) : with(DEtools) : with(plots, implicitplot)
                              [implicitplot]
> ρ1 := 0.3; ρ2 := ρ2; β := β; δ2 := 0.04; ω := 0.5; μ := 0.00322; σ := 0.17; δ := 0.2;

> R0 := (1 − ρ1)·(1 − ρ2)·β·(ω + μ + δ2) / (δ + μ + σ)·(ω + μ)
> R0
>
> implicitplot(R0 = 1, ρ2 = 0 ..1, β = 0 ..1)
> ρ2 := 0.3; β := 0.6;

> R0
```