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LAMPIRAN

LAMPIRAN

Lampiran 1

Penentuan banyaknya N sampai terjadi kegagalan, terlebih dahulu dengan menentukan nilai *constant-life fatigue line slope* (m) dan nilai *constant-life fatigue line y-intercept* (S) - *Kondisi Angin Normal Sidrap*

10 Meter				**50 Meter**		
n	**m**	**S**		**n**	**m**	**S**
n1	-0,006803647	2,258810723		n1	-0,014848713	4,929772732
n2	-0,006728978	2,234020774		n2	-0,014420462	4,787593527
n3	-0,006623174	2,19889393		n3	-0,014016222	4,653385583
n4	-0,006536589	2,1701474		n4	-0,013634027	4,526496818
n5	-0,006468264	2,147463505		n5	-0,013272122	4,406344385
n6	-0,006369832	2,114784381		n6	-0,012928933	4,292405723
n7	-0,006305329	2,093369184		n7	-0,012603045	4,184210958
n8	-0,006214459	2,063200524		n8	-0,012293182	4,081336424
n9	-0,003080066	1,022582025		n9	-0,0060275	2,001130156
n10	-0,003061209	1,01632135		n10	-0,005971121	1,982412333
n11	-0,003042581	1,010136871		n11	-0,005893036	1,956488087
n12	-0,001514379	0,50277384		n12	-0,002919943	0,969421116
n13	-0,00060447	0,20068406		n13	-0,001163524	0,386290082
25 Meter				75 Meter		
n	**m**	**S**		**n**	**m**	**S**
n1	-0,010448435	3,468880267		n1	-0,018446582	6,124265289
n2	-0,010217069	3,392066747		n2	-0,017790244	5,906360944
n3	-0,010012472	3,324140798		n3	-0,017179006	5,703430119
n4	-0,009815909	3,258881869		n4	-0,016608376	5,5139807
n5	-0,009626915	3,196135909		n5	-0,016074435	5,33671245
n6	-0,009445062	3,135760507		n6	-0,015556853	5,164875167
n7	-0,00928584	3,082898978		n7	-0,015103828	5,014471033
n8	-0,009100929	3,021508424		n8	-0,014660955	4,867437162
n9	-0,004486088	1,489381268		n9	-0,00718059	2,383955967
n10	-0,004449261	1,477154813		n10	-0,007064995	2,34557818
n11	-0,004411538	1,464630635		n11	-0,006972664	2,314924577
n12	-0,002192025	0,72775231		n12	-0,003449488	1,145229984
n13	-0,000873221	0,289909531		n13	-0,001373466	0,455990781

Siklus kejadian pada skala log (LN), dan nilai kejadian (N) secara berturut-turut di setiap level ketinggian - *Kondisi Angin Normal Sidrap*

10 Meter					
Mean Stress	**n**	**LS**	**LN**	**N**	**D**
38,04	2	0,353879841	14,18415582	1,53E+14	1,31E-14
34,04	3	0,349087207	14,20942169	1,62E+14	1,85E-14
30,03	12	0,34220428	14,2457072	1,76E+14	6,82E-14
26,03	11,5	0,336489233	14,27583586	1,89E+14	6,09E-14
22,03	31	0,331925792	14,29989347	1,99E+14	1,55E-13
18,02	32	0,325266094	14,33500215	2,16E+14	1,48E-13
14,02	40	0,320845827	14,35830497	2,28E+14	1,75E-13
10,01	60	0,314541439	14,39154053	2,46E+14	2,44E-13
7,01	53	0,009698154	15,9986174	9,97E+15	5,32E-15
5,01	84	0,007031049	16,01267788	1,03E+16	8,16E-15
3	207	0,004380223	16,02665254	1,06E+16	1,95E-14
1,5	240	-0,298627327	17,62405177	4,21E+17	5,70E-16
0,8	192	-0,697487122	19,72676613	5,33E+19	3,60E-18
25 Meter					
Mean Stress	**n**	**LS**	**LN**	**N**	**D**
54,93	1,5	0,54018931	13,20196709	1,59E+13	9,42E-14
49,14	1	0,530464389	13,25323505	1,79E+13	5,58E-14
43,36	4	0,521679411	13,29954782	1,99E+13	2,01E-13
37,58	5	0,513068618	13,34494231	2,21E+13	2,26E-13
31,8	17	0,504625239	13,38945423	2,45E+13	6,93E-13
26,02	34,5	0,496342886	13,43311725	2,71E+13	1,27E-12
20,24	49,5	0,488959294	13,47204217	2,97E+13	1,67E-12
14,45	62,5	0,480223809	13,51809401	3,30E+13	1,90E-12
10,12	50	0,173005887	15,13768953	1,37E+15	3,64E-14
7,23	89,5	0,169426014	15,15656195	1,43E+15	6,24E-14
4,34	226,5	0,165728114	15,17605659	1,50E+15	1,51E-13
2,17	236	-0,138016407	16,77734099	5,99E+16	3,94E-15
1,16	159,5	-0,537737506	18,88459598	7,67E+18	2,08E-17
50 Meter					
Mean Stress	**n**	**LS**	**LN**	**N**	**D**
73,06	1	0,692826898	12,39729023	2,50E+12	4,01E-13
65,37	0,5	0,680117271	12,46429301	2,91E+12	1,72E-13
57,68	2,5	0,66776904	12,52939058	3,38E+12	7,39E-13
49,99	1	0,655762219	12,59268829	3,91E+12	2,55E-13
42,3	3,5	0,644078437	12,65428301	4,51E+12	7,76E-13
34,61	20	0,632700765	12,71426397	5,18E+12	3,86E-12

26,92	45,5	0,621613572	12,77271358	5,93E+12	7,68E-12
19,23	59,5	0,610802395	12,82970809	6,76E+12	8,81E-12
13,46	58	0,301275337	14,46147694	2,89E+14	2,00E-13
9,62	101	0,297193991	14,48299304	3,04E+14	3,32E-13
5,77	230,5	0,291477208	14,51313085	3,26E+14	7,07E-13
2,88	277	-0,013487525	16,12084797	1,32E+16	2,10E-14
1,54	193	-0,413086442	18,22745885	1,69E+18	1,14E-16
75 Meter					
Mean Stress	**n**	**LS**	**LN**	**N**	**D**
86,16	1	0,787053995	11,90054257	7,95E+11	1,26E-12
77,09	0	0,771319984	11,98348934	9,63E+11	0
68,02	2	0,756136125	12,0635358	1,16E+12	1,73E-12
58,95	3,5	0,741465242	12,14087796	1,38E+12	2,53E-12
49,88	8	0,727273803	12,21569258	1,64E+12	4,87E-12
40,81	13	0,713059829	12,29062599	1,95E+12	6,66E-12
31,75	41	0,700225127	12,35828815	2,28E+12	1,80E-11
22,68	64,5	0,687300354	12,42642514	2,67E+12	2,42E-11
15,87	68,5	0,37729823	14,06069845	1,15E+14	5,96E-13
11,33	115	0,370249913	14,09785586	1,25E+14	9,18E-13
6,8	256	0,364536846	14,12797408	1,34E+14	1,91E-12
3,4	296	0,05889271	15,73927289	5,49E+15	5,40E-14
1,81	196	-0,341043938	17,84766422	7,04E+17	2,78E-16

Penentuan banyaknya N sampai terjadi kegagalan, terlebih dahulu dengan menentukan nilai *constant-life fatigue line slope* (m) dan nilai *constant-life fatigue line y-intercept* (S) *- Kondisi Angin Abnormal Sidrap*

10 Meter		
n	m	S
n1	-0,01111	3,687611
n2	-0,01087	3,607472
n3	-0,01063	3,530743
n4	-0,01041	3,45721
n5	-0,0102	3,386677
n6	-0,01	3,318965
n7	-0,0098	3,253907
n8	-0,00961	3,19135
n9	-0,00474	1,572995
n10	-0,00469	1,558229
n11	-0,00465	1,543738
n12	-0,00231	0,766774
n13	-0,00138	0,45797
25 Meter		
n	m	S
n1	-0,01769	5,872618
n2	-0,0171	5,678302
n3	-0,01652	5,484355
n4	-0,01599	5,308956
n5	-0,0155	5,144429
n6	-0,01505	4,995384
n7	-0,01459	4,84402
n8	-0,01418	4,706675
n9	-0,00695	2,306939
n10	-0,00685	2,273778
n11	-0,00675	2,242547
n12	-0,00334	1,11053
n13	-0,002	0,66242

50 Meter		
n	m	S
n1	-0,02649	8,794204
n2	-0,02522	8,372627
n3	-0,02395	7,950712
n4	-0,02285	7,587312
n5	-0,02184	7,249612
n6	-0,02094	6,952071
n7	-0,02008	6,667033
n8	-0,01932	6,414982
n9	-0,00939	3,117146
n10	-0,0092	3,054509
n11	-0,00905	3,005427
n12	-0,00446	1,481573
n13	-0,00266	0,882441
75 Meter		
n	m	S
n1	-0,0286	9,494536
n2	-0,02716	9,016383
n3	-0,02566	8,518148
n4	-0,02442	8,108807
n5	-0,02329	7,731154
n6	-0,02223	7,381245
n7	-0,0213	7,072631
n8	-0,02043	6,783607
n9	-0,0099	3,288293
n10	-0,00971	3,224421
n11	-0,00954	3,166548
n12	-0,0047	1,55968
n13	-0,0028	0,929027

Siklus kejadian pada skala log (LN), dan nilai kejadian (N) secara berturut-turut di setiap level ketinggian. - *Kondisi Angin Abnormal Sidrap*

10 Meter					
Mean Stress	n	LS	LN	N	D
57,86	2	0,566745051	13,06197018	1,15E+13	1,73E-13
51,77	3	0,557203005	13,11227407	1,30E+13	2,32E-13
45,68	12	0,547866111	13,16149643	1,45E+13	8,27E-13
39,59	11,5	0,538725734	13,20968279	1,62E+13	7,10E-13
33,5	31	0,529773771	13,25687587	1,81E+13	1,72E-12
27,41	32	0,521002611	13,30311579	2,01E+13	1,59E-12
21,32	40	0,512405095	13,34844028	2,23E+13	1,79E-12
15,23	60	0,503974481	13,3928849	2,47E+13	2,43E-12
10,66	53	0,196727217	15,01263511	1,03E+15	5,15E-14
7,61	84	0,192631274	15,03422815	1,08E+15	7,76E-14
4,57	207	0,188573601	15,05561945	1,14E+15	1,82E-13
2,28	240	-0,11533269	16,65775667	4,55E+16	5,28E-15
1,07	326	-0,339163179	17,83774921	6,88E+17	4,74E-16
25 Meter					
Mean Stress	n	LS	LN	N	D
83,54	1,5	0,768831743	11,99660688	9,92E+11	1,51E-12
74,74	1	0,754218495	12,07364519	1,18E+12	8,44E-13
65,95	4	0,739125538	12,15321244	1,42E+12	2,81E-12
57,16	5	0,725009122	12,22763155	1,69E+12	2,96E-12
48,37	17	0,711337142	12,29970768	1,99E+12	8,53E-12
39,57	34,5	0,698568836	12,3670198	2,33E+12	1,48E-11
30,78	49,5	0,68520595	12,43746644	2,74E+12	1,81E-11
21,99	62,5	0,672714256	12,50332032	3,19E+12	1,96E-11
15,39	50	0,363036137	14,13588554	1,37E+14	3,66E-13
10,99	89,5	0,356748021	14,16903531	1,48E+14	6,06E-13
6,6	226,5	0,35074155	14,2007003	1,59E+14	1,43E-12
3,3	236	0,04553031	15,80971697	6,45E+15	3,66E-14
1,54	328,5	-0,178866578	16,99269546	9,83E+16	3,34E-15
50 Meter					
Mean Stress	n	LS	LN	N	D
111,15	1	0,944196546	11,07211638	1,18E+11	8,47E-12
99,44	0,5	0,922861744	11,18458947	1,53E+11	3,27E-12
87,72	2,5	0,900406038	11,30297176	2,01E+11	1,24E-11
76,02	1	0,880087915	11,41008511	2,57E+11	3,89E-12
64,33	3,5	0,860314788	11,51432535	3,27E+11	1,07E-11
52,63	20	0,842114182	11,61027554	4,08E+11	4,91E-11
40,94	45,5	0,823932614	11,70612537	5,08E+11	8,95E-11
29,24	59,5	0,807195453	11,79436056	6,23E+11	9,55E-11
20,47	58	0,493757109	13,44674898	2,80E+13	2,07E-12
14,62	101	0,484941379	13,49322386	3,11E+13	3,24E-12

8,77	230,5	0,477906118	13,53031245	3,39E+13	6,80E-12
4,39	277	0,170723004	15,14972446	1,41E+15	1,96E-13
2,05	333	-0,054314404	16,33607966	2,17E+16	1,54E-14
75 Meter					
Mean Stress	n	LS	LN	N	D
116,95	0,5	0,977473753	10,89668516	7,8829E+10	6,34E-12
104,63	1,5	0,955032334	11,01499213	1,04E+11	1,45E-11
92,3	5,5	0,930345165	11,14513827	1,40E+11	3,94E-11
80	8	0,908956983	11,25789277	1,81E+11	4,42E-11
67,69	14,5	0,888244331	11,36708601	2,33E+11	6,23E-11
55,38	27	0,868129622	11,473127	2,97E+11	9,08E-11
43,08	43,5	0,849581019	11,57091177	3,72E+11	1,17E-10
30,77	72,5	0,831460711	11,66643865	4,64E+11	1,56E-10
21,54	90	0,516970556	13,32437202	2,11E+13	4,26E-12
15,39	150	0,508451718	13,36928175	2,34E+13	6,41E-12
9,23	281,5	0,500586098	13,41074783	2,57E+13	1,09E-11
4,62	300,5	0,193035642	15,0320964	1,08E+15	2,79E-13
2,15	312	-0,031971437	16,21829171	1,65E+16	1,89E-14

Penentuan banyaknya N sampai terjadi kegagalan, terlebih dahulu dengan menentukan nilai *constant-life fatigue line slope* (m) dan nilai *constant-life fatigue line y-intercept* (S) *- Kondisi Normal Jeneponto*

10 Meter		
n	m	S
n1	-0,01237	4,106542
n2	-0,01207	4,007406
n3	-0,01179	3,912943
n4	-0,01151	3,822832
n5	-0,01126	3,736777
n6	-0,01102	3,659946
n7	-0,01077	3,575674
n8	-0,01054	3,500277
n9	-0,00519	1,721861
n10	-0,00514	1,705715
n11	-0,00508	1,687861
n12	-0,00252	0,837795
n13	-0,00101	0,333988

25 Meter		
n	m	S
n1	-0,01045	3,46888
n2	-0,01022	3,392067
n3	-0,01001	3,324141
n4	-0,00982	3,258882
n5	-0,00963	3,196136
n6	-0,00945	3,135761
n7	-0,00929	3,082899
n8	-0,0091	3,021508
n9	-0,00449	1,489381
n10	-0,00445	1,477155
n11	-0,00441	1,464631
n12	-0,00219	0,727752
n13	-0,00087	0,28991

50 Meter		
n	m	S
n1	-0,01485	4,929773
n2	-0,01442	4,787594
n3	-0,01402	4,653386
n4	-0,01363	4,526497
n5	-0,01327	4,406344
n6	-0,01293	4,292406
n7	-0,0126	4,184211

75 Meter		
n	m	S
n1	-0,01845	6,124265
n2	-0,01779	5,906361
n3	-0,01718	5,70343
n4	-0,01661	5,513981
n5	-0,01607	5,336712
n6	-0,01556	5,164875
n7	-0,0151	5,014471
n8	-0,01466	4,867437
n9	-0,00718	2,383956
n10	-0,00706	2,345578
n11	-0,00697	2,314925
n12	-0,00345	1,14523
n13	-0,00137	0,455991

100 Meter		
n	m	S
n1	-0,01585	5,263851
n2	-0,01539	5,108274
n3	-0,01491	4,949745
n4	-0,01448	4,806428
n5	-0,01407	4,671177
n6	-0,01368	4,543329
n7	-0,01332	4,422294
n8	-0,01299	4,312795
n9	-0,00636	2,109992
n10	-0,00629	2,087609
n11	-0,00621	2,060669
n12	-0,00307	1,02083
n13	-0,00122	0,406482

n8	-0,01229	4,081336		
n9	-0,00603	2,00113		
n10	-0,00597	1,982412		
n11	-0,00589	1,956488		
n12	-0,00292	0,969421		
n13	-0,00116	0,38629		

Siklus kejadian pada skala log (LN), dan nilai kejadian (N) secara berturut-turut di setiap level ketinggian. - *Kondisi Normal Jeneponto*

10 Meter					
Mean Stress	n	LS	LN	N	D
57,86	2	0,566745	13,06197	1,15E+13	1,73E-13
51,77	3	0,557203	13,11227	1,30E+13	2,32E-13
45,68	12	0,547866	13,1615	1,45E+13	8,27E-13
39,59	11,5	0,538726	13,20968	1,62E+13	7,10E-13
33,5	31	0,529774	13,25688	1,81E+13	1,72E-12
27,41	32	0,521003	13,30312	2,01E+13	1,59E-12
21,32	40	0,512405	13,34844	2,23E+13	1,79E-12
15,23	60	0,503974	13,39288	2,47E+13	2,43E-12
10,66	53	0,196727	15,01264	1,03E+15	5,15E-14
7,61	84	0,192631	15,03423	1,08E+15	7,76E-14
4,57	207	0,188574	15,05562	1,14E+15	1,82E-13
2,28	240	-0,11533	16,65776	4,55E+16	5,28E-15
1,07	326	-0,33916	17,83775	6,88E+17	4,74E-16
25 Meter					
Mean Stress	n	LS	LN	N	D
83,54	1,5	0,768832	11,99661	9,92E+11	1,51E-12
74,74	1	0,754218	12,07365	1,18E+12	8,44E-13
65,95	4	0,739126	12,15321	1,42E+12	2,81E-12
57,16	5	0,725009	12,22763	1,69E+12	2,96E-12
48,37	17	0,711337	12,29971	1,99E+12	8,53E-12
39,57	34,5	0,698569	12,36702	2,33E+12	1,48E-11
30,78	49,5	0,685206	12,43747	2,74E+12	1,81E-11
21,99	62,5	0,672714	12,50332	3,19E+12	1,96E-11
15,39	50	0,363036	14,13589	1,37E+14	3,66E-13
10,99	89,5	0,356748	14,16904	1,48E+14	6,06E-13
6,6	226,5	0,350742	14,2007	1,59E+14	1,43E-12
3,3	236	0,04553	15,80972	6,45E+15	3,66E-14
1,54	328,5	-0,17887	16,9927	9,83E+16	3,34E-15
50 Meter					
Mean Stress	n	LS	LN	N	D
111,15	1	0,944197	11,07212	1,18E+11	8,47E-12
99,44	0,5	0,922862	11,18459	1,53E+11	3,27E-12
87,72	2,5	0,900406	11,30297	2,01E+11	1,24E-11
76,02	1	0,880088	11,41009	2,57E+11	3,89E-12
64,33	3,5	0,860315	11,51433	3,27E+11	1,07E-11
52,63	20	0,842114	11,61028	4,08E+11	4,91E-11
40,94	45,5	0,823933	11,70613	5,08E+11	8,95E-11
29,24	59,5	0,807195	11,79436	6,23E+11	9,55E-11
20,47	58	0,493757	13,44675	2,80E+13	2,07E-12
14,62	101	0,484941	13,49322	3,11E+13	3,24E-12

8,77	230,5	0,477906	13,53031	3,39E+13	6,80E-12
4,39	277	0,170723	15,14972	1,41E+15	1,96E-13
2,05	333	-0,05431	16,33608	2,17E+16	1,54E-14
75 Meter					
Mean Stress	n	LS	LN	N	D
116,95	0,5	0,977474	10,89669	7,88E+10	6,34E-12
104,63	1,5	0,955032	11,01499	1,04E+11	1,45E-11
92,3	5,5	0,930345	11,14514	1,40E+11	3,94E-11
80	8	0,908957	11,25789	1,81E+11	4,42E-11
67,69	14,5	0,888244	11,36709	2,33E+11	6,23E-11
55,38	27	0,86813	11,47313	2,97E+11	9,08E-11
43,08	43,5	0,849581	11,57091	3,72E+11	1,17E-10
30,77	72,5	0,831461	11,66644	4,64E+11	1,56E-10
21,54	90	0,516971	13,32437	2,11E+13	4,26E-12
15,39	150	0,508452	13,36928	2,34E+13	6,41E-12
9,23	281,5	0,500586	13,41075	2,57E+13	1,09E-11
4,62	300,5	0,193036	15,0321	1,08E+15	2,79E-13
2,15	312	-0,03197	16,21829	1,65E+16	1,89E-14

Penentuan banyaknya N sampai terjadi kegagalan, terlebih dahulu dengan menentukan nilai *constant-life fatigue line slope* (m) dan nilai *constant-life fatigue line y-intercept* (S) *- Kondisi Abnormal Jeneponto*

10 Meter		
n	m	S
n1	-0,01111	3,687611
n2	-0,01087	3,607472
n3	-0,01063	3,530743
n4	-0,01041	3,45721
n5	-0,0102	3,386677
n6	-0,01	3,318965
n7	-0,0098	3,253907
n8	-0,00961	3,19135
n9	-0,00474	1,572995
n10	-0,00469	1,558229
n11	-0,00465	1,543738
n12	-0,00231	0,766774
n13	-0,00092	0,30537
25 Meter		
n	m	S
n1	-0,01769	5,872618
n2	-0,0171	5,678302
n3	-0,01652	5,484355
n4	-0,01599	5,308956
n5	-0,0155	5,144429
n6	-0,01505	4,995384
n7	-0,01459	4,84402
n8	-0,01418	4,706675
n9	-0,00695	2,306939
n10	-0,00685	2,273778
n11	-0,00675	2,242547
n12	-0,00334	1,11053
n13	-0,00133	0,44184
50 Meter		
n	m	S
n1	-0,01485	4,929773
n2	-0,01442	4,787594
n3	-0,01402	4,653386
n4	-0,01363	4,526497
n5	-0,01327	4,406344
n6	-0,01293	4,292406
n7	-0,0126	4,184211

75 Meter		
n	m	S
n1	-0,03433	11,39701
n2	-0,03212	10,6648
n3	-0,03008	9,985781
n4	-0,02845	9,44579
n5	-0,02694	8,943546
n6	-0,02554	8,480338
n7	-0,0243	8,068165
n8	-0,02318	7,6942
n9	-0,01121	3,720522
n10	-0,01096	3,638963
n11	-0,01072	3,55784
n12	-0,00527	1,751282
n13	-0,00209	0,695277
100 Meter		
n	m	S
n1	-0,0286	9,494536
n2	-0,02716	9,016383
n3	-0,02566	8,518148
n4	-0,02442	8,108807
n5	-0,02329	7,731154
n6	-0,02223	7,381245
n7	-0,0213	7,072631
n8	-0,02043	6,783607
n9	-0,0099	3,288293
n10	-0,00971	3,224421
n11	-0,00954	3,166548
n12	-0,0047	1,55968
n13	-0,00187	0,620098

n8	-0,01229	4,081336		
n9	-0,00603	2,00113		
n10	-0,00597	1,982412		
n11	-0,00589	1,956488		
n12	-0,00292	0,969421		
n13	-0,00116	0,38629		

Siklus kejadian pada skala log (LN), dan nilai kejadian (N) secara berturut-turut di setiap level ketinggian. - *Kondisi Abnormal Jeneponto*

10 Meter					
Mean Stress	n	LS	LN	N	D
57,86	2	0,566745	13,06197	1,15E+13	1,73E-13
51,77	3	0,557203	13,11227	1,30E+13	2,32E-13
45,68	12	0,547866	13,1615	1,45E+13	8,27E-13
39,59	11,5	0,538726	13,20968	1,62E+13	7,10E-13
33,5	31	0,529774	13,25688	1,81E+13	1,72E-12
27,41	32	0,521003	13,30312	2,01E+13	1,59E-12
21,32	40	0,512405	13,34844	2,23E+13	1,79E-12
15,23	60	0,503974	13,39288	2,47E+13	2,43E-12
10,66	53	0,196727	15,01264	1,03E+15	5,15E-14
7,61	84	0,192631	15,03423	1,08E+15	7,76E-14
4,57	207	0,188574	15,05562	1,14E+15	1,82E-13
2,28	240	-0,11533	16,65776	4,55E+16	5,28E-15
1,22	192	-0,51517	18,76564	5,83E+18	3,29E-17
25 Meter					
Mean Stress	n	LS	LN	N	D
83,54	1,5	0,768832	11,99661	9,92E+11	1,51E-12
74,74	1	0,754218	12,07365	1,18E+12	8,44E-13
65,95	4	0,739126	12,15321	1,42E+12	2,81E-12
57,16	5	0,725009	12,22763	1,69E+12	2,96E-12
48,37	17	0,711337	12,29971	1,99E+12	8,53E-12
39,57	34,5	0,698569	12,36702	2,33E+12	1,48E-11
30,78	49,5	0,685206	12,43747	2,74E+12	1,81E-11
21,99	62,5	0,672714	12,50332	3,19E+12	1,96E-11
15,39	50	0,363036	14,13589	1,37E+14	3,66E-13
10,99	89,5	0,356748	14,16904	1,48E+14	6,06E-13
6,6	226,5	0,350742	14,2007	1,59E+14	1,43E-12
3,3	236	0,04553	15,80972	6,45E+15	3,66E-14
1,76	159,5	-0,35473	17,91984	8,31E+17	1,92E-16
50 Meter					
Mean Stress	n	LS	LN	N	D
73,06	1	0,692827	12,39729	2,50E+12	4,01E-13
65,37	0,5	0,680117	12,46429	2,91E+12	1,72E-13
57,68	2,5	0,667769	12,52939	3,38E+12	7,39E-13
49,99	1	0,655762	12,59269	3,91E+12	2,55E-13
42,3	3,5	0,644078	12,65428	4,51E+12	7,76E-13
34,61	20	0,632701	12,71426	5,18E+12	3,86E-12
26,92	45,5	0,621614	12,77271	5,93E+12	7,68E-12
19,23	59,5	0,610802	12,82971	6,76E+12	8,81E-12

13,46	58	0,301275	14,46148	2,89E+14	2,00E-13
9,62	101	0,297194	14,48299	3,04E+14	3,32E-13
5,77	230,5	0,291477	14,51313	3,26E+14	7,07E-13
2,88	277	-0,01349	16,12085	1,32E+16	2,10E-14
1,54	193	-0,41309	18,22746	1,69E+18	1,14E-16
75 Meter					
Mean Stress	n	LS	LN	N	D
131	1	1,056791	10,47854	3,01E+10	3,32E-11
117,2	0	1,027953	10,63057	4,27E+10	0
103,43	2	0,999382	10,78119	6,04E+10	3,31E-11
89,66	3,5	0,975238	10,90847	8,1E+10	4,32E-11
75,86	8	0,95151	11,03356	1,08E+11	7,41E-11
62,07	13	0,928413	11,15532	1,43E+11	9,09E-11
48,28	41	0,906775	11,2694	1,86E+11	2,20E-10
34,49	64,5	0,886163	11,37806	2,39E+11	2,70E-10
24,14	68,5	0,570604	13,04163	1,10E+13	6,22E-12
17,24	115	0,560978	13,09237	1,24E+13	9,30E-12
10,34	256	0,551186	13,14399	1,39E+13	1,84E-11
5,17	296	0,243356	14,76682	5,85E+14	5,06E-13
2,76	196	-0,15784	16,88186	7,62E+16	2,57E-15
100 Meter					
Mean Stress	n	LS	LN	N	D
116,95	0,5	0,977474	10,89669	7,88E+10	6,34E-12
104,63	1,5	0,955032	11,01499	1,04E+11	1,45E-11
92,3	5,5	0,930345	11,14514	1,40E+11	3,94E-11
80	8	0,908957	11,25789	1,81E+11	4,42E-11
67,69	14,5	0,888244	11,36709	2,33E+11	6,23E-11
55,38	27	0,86813	11,47313	2,97E+11	9,08E-11
43,08	43,5	0,849581	11,57091	3,72E+11	1,17E-10
30,77	72,5	0,831461	11,66644	4,64E+11	1,56E-10
21,54	90	0,516971	13,32437	2,11E+13	4,26E-12
15,39	150	0,508452	13,36928	2,34E+13	6,41E-12
9,23	281,5	0,500586	13,41075	2,57E+13	1,09E-11
4,62	300,5	0,193036	15,0321	1,08E+15	2,79E-13
2,46	184	-0,20754	17,14386	1,39E+17	1,32E-15

Lampiran 2

Pemograman *Rain Flow Counting Algorithm* dengan MATLAB

```
%clc;
clear all;
%
close all;
%
clear B;
clear a;
clear aa;
clear cc;
clear THM;
clear THM_hold;
clear t;
clear C;
clear y;
clear L;
clear max;
clear size;
clear m;
clear k;
clear iscale;
clear length;
clear slope1;
clear slope2;
clear BIG;
clear dat;
clear data_s;

%
tic
%
fig_num=1;
%
disp(' Input file harus berupa histori waktu & stress amplitude. ')
disp('   Tekan angka 3 dan Enter untuk load file histori');

file_choice = input('');
ic = 3;
%
   if(file_choice==3)
      [filename, pathname] = uigetfile('*.*');
      xfile = fullfile(pathname, filename);
%
       THM = xlsread(xfile);
```

```
%
    end
    y=double(THM(:,2));
%
% end
figure(fig_num);
fig_num=fig_num+1;
if(ic==3)
    plot(y);
else
    plot(THM(:,1),THM(:,2));
end
grid on;
THM_hold=THM;
clear THM;
%
m=length(y)-1;
a=zeros(m,1);
t=zeros(m,1);
a(1)=y(1);
t(1)=1;
k=2;
%
out1=sprintf(' Total data input =%d ',m);
disp(out1);

%
disp(' Begin slope calculation ')
%
slope1=(  y(2)-y(1));
for i=2:m
    slope2=(y(i+1)-y(i));
    if((slope1*slope2)<=0)
        a(k)=y(i);
        t(k)=i;
        k=k+1;
    end
    slope1=slope2;
end
%
a(k)=y(m+1);
t(k)=t(k-1)+1;
k=k+1;
%
disp(' End slope calculation ')
%
clear temp;
```

```
temp(1:k-1)=a(1:k-1);
clear a;
a=temp;
%
clear temp;
temp(1:k-1)=t(1:k-1);
clear t;
t=temp;
%
clear aa;
sza=size(a);
if(sza(2)>sza(1))
   a=a';
end
szt=size(t);
if(szt(2)>szt(1))
   t=t';
end
%
aa=[t a];
%
cc=a;
%
% num=round(max(a)-min(a))+1;
%
n=1;
i=1;
j=2;
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%   Rules for this method are as follows: let X denote
%   range under consideration; Y, previous range adjacent to X; and
%   S, starting point in the history.
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%
clear B;
aamax=0;
B=zeros(m,4);
a_mean=zeros(m,2);
kv=1;
msa_orig=max(size(aa));
while(1)
   msa=max(size(aa));
```

```
%
   if((j+1)>msa)
      break;
   end
   if((i+1)>=msa)
      break;
   end
%
   Y=(abs(aa(i,2)-aa(i+1,2)));
   X=(abs(aa(j,2)-aa(j+1,2)));
%
   if(X>=Y && Y>0)
      if(i==1)
        B(kv,2)=0.5;
        am=[aa(i,2) aa(i+1,2)];
        B(kv,3)=am(1);
        B(kv,4)=am(2);
        aa(1,:)=[];
      else
        B(kv,2)=1;
        am=[aa(i,2) aa(i+1,2)];
        B(kv,3)=am(1);
        B(kv,4)=am(2);
        aa(i+1,:)=[];
        aa(i,:)=[];
      end
      B(kv,1)=Y;
%%
%%                        out1=sprintf('   %8.4g      %8.4g      %8.4g      %8.4g
',B(kv,1),B(kv,2),B(kv,3),B(kv,4));
%%       disp(out1);
%%
      if(Y>aamax)
         p1=aa(i,2);
         p2=aa(i+1,2);
         tp1=aa(i,1);
         tp2=aa(i+1,1);
         aamax=Y;
      end
      kv=kv+1;
      i=1;
      j=2;
   else
      i=i+1;
      j=j+1;
   end
%
end
```

```
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%  Count each range that has not been previously counted
%  as one-half cycle.
%
N=max(size(aa));
disp(' ');
for i=1:N-1
   Y=(abs(aa(i,2)-aa(i+1,2)));
%
   if(Y>0)
      B(kv,1)=Y;
      B(kv,2)=0.5;
      am=[aa(i,2) aa(i+1,2)];
      B(kv,3)=am(1);
      B(kv,4)=am(2);
%%
%%                     out1=sprintf('*   %8.4g      %8.4g      %8.4g      %8.4g
',B(kv,1),B(kv,2),B(kv,3),B(kv,4));
%%       disp(out1);
%%
      if(Y>aamax)
         p1=aa(i,2);
         p2=aa(i+1,2);
         tp1=aa(i,1);
         tp2=aa(i+1,1);
         aamax=Y;
      end
      kv=kv+1;
   end
end
%
amax=max(y)-min(y);
%
disp(' Begin bin sorting ');
%
amax=max(B(:,1));
%    Filter

L(1)=0.5;
L(1)=1;
L(1)=1.5;
L(2)=2.5;
L(3)=5;
L(4)=10;
L(5)=15;
```

```
L(6)=20;
L(7)=30;
L(8)=40;
L(9)=50;
L(10)=60;
L(11)=70;
L(12)=80;
L(13)=90;
L(14)=100;
L=L*amax/100;


%
clear AverageMean;
clear MaxMean;
clear MinMean;
%
clear MaxAmp;
clear AverageAmp;
%
clear MinValley;
clear MaxPeak;
%
num=max(size(L))-1;
C=zeros(num,1);
%
AverageMean=zeros(num,1);
MaxMean=-1.0e+09*ones(num,1);
MinMean= 1.0e+09*ones(num,1);
%
MaxPeak=-1.0e+09*ones(num,1);
MinValley= 1.0e+09*ones(num,1);
%
MaxAmp=zeros(num,1);
AverageAmp=zeros(num,1);
%
kvn=kv-1;
%
clear range_cycles;
clear amp_cycles;
%
range_cycles=[B(1:kvn,1) B(1:kvn,2)];
amp_cycles=[0.5*B(1:kvn,1) B(1:kvn,2)];
%
for i=1:kvn
    for ijk=1:num
       Y=B(i,1);
       if(Y>=L(ijk) && Y<=L(ijk+1))
```

```
            C(ijk)=C(ijk)+B(i,2);
            bm=(B(i,3)+B(i,4))/2;
            if(B(i,3)>MaxPeak(ijk))
               MaxPeak(ijk)=B(i,3);
            end
            if(B(i,4)>MaxPeak(ijk))
               MaxPeak(ijk)=B(i,4);
            end
            if(B(i,3)<MinValley(ijk))
               MinValley(ijk)=B(i,3);
            end
            if(B(i,4)<MinValley(ijk))
               MinValley(ijk)=B(i,4);
            end
%
            AverageAmp(ijk)=AverageAmp(ijk)+B(i,1)*B(i,2);
            AverageMean(ijk)=AverageMean(ijk)+bm*B(i,2);
%
            if( bm > MaxMean(ijk))
               MaxMean(ijk)=bm;
            end
            if( bm < MinMean(ijk))
               MinMean(ijk)=bm;
            end
%
            if(B(i,1)>MaxAmp(ijk))
              MaxAmp(ijk)=B(i,1);
            end
            break;
        end
    end
end
for ijk=1:num
    if( C(ijk)>0)
       AverageAmp(ijk)=AverageAmp(ijk)/C(ijk);
       AverageMean(ijk)=AverageMean(ijk)/C(ijk);
    end
end
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%   disp(' ');
%   disp(' Round the cycle and amplitude values to nearest integer ? ');
%   disp(' 1=yes 2=no');
%   rv=input(' ');
  rv=1;
%
  clear BIG;
```

```
  N=max(size(C));
  BIG=zeros(N,10);
  disp(' ');
  disp('      Range = (peak-valley) ');
  disp('  Amplitude = (peak-valley)/2 ');
  disp(' ');
  disp('       Range Limits        Cycle     Average     Max      Min     Average
Max   Min     Max ');
  disp('          (units)          Counts      Amp       Amp      Mean     Mean
Mean  Valley  Peak');
%
  MaxAmp=MaxAmp/2;
  AverageAmp=AverageAmp/2;
%
  for i=1:N
      j=N+1-i;
%
      if(C(j)==0)
        AverageAmp(j)=0.;
        MaxAmp(j)=0.;
        MinMean(j)=0.;
        AverageMean(j)=0.;
        MaxMean(j)=0.;
        MinValley(j)=0.;
        MaxPeak(j)=0.;
      end
%
      if(rv==2)
         out1=sprintf('\t %7.4g to %7.4g \t %g \t %6.3g \t %6.3g \t %6.3g\t
%6.3g\t                    %6.3g\t                    %6.3g\t
%6.3g',L(j),L(j+1),C(j),AverageAmp(j),MaxAmp(j),MinMean(j),AverageMea
n(j),MaxMean(j),MinValley(j),MaxPeak(j));
      else
         out1=sprintf('\t %7.4g to %7.4g \t %g \t %6.3g \t %6.3g \t %6.3g\t
%6.3g\t                    %6.3g\t                    %6.3g\t
%6.3g',L(j),L(j+1),round(C(j)),round(AverageAmp(j)),round(MaxAmp(j)),rou
nd(MinMean(j)),round(AverageMean(j)),round(MaxMean(j)),round(MinVall
ey(j)),round(MaxPeak(j)));
      end
      disp(out1);
      BIG(i,1)=L(j);
      BIG(i,2)=L(j+1);
      BIG(i,3)=C(j);
      BIG(i,4)=AverageAmp(j);
      BIG(i,5)=MaxAmp(j);
      BIG(i,6)=MinMean(j);
      BIG(i,7)=AverageMean(j);
      BIG(i,8)=MaxMean(j);
```

```
      BIG(i,9)=MinValley(j);
      BIG(i,10)=MaxPeak(j);
  end
%
out1=sprintf('\n  Max Range=%6.3g ',aamax);
disp(out1);
%
TC=sum(C);
if(rv==2)
   out1=sprintf('\n Total Cycles =%g \n',TC);
else
   out1=sprintf('\n Total Cycles =%g \n',round(TC));
end
disp(out1);
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%%
% disp(' ');
% % disp(' Present data in Matlab uitable?  1=yes 2=no ')
% ip=input(' ');
%%
ip = 1;
%
close all hidden;
%
if(ip==1)
%
%
    table1 = uitable;
    set(table1,'ColumnWidth',{26})
    f = figure('Position',[100 100 900 350]);
    dat =  BIG(:,1:10);
columnname =   {'Sress Min','Stress Max','Cycles','Ave Amp',...
       'Max Amp','Min Mean','Ave Mean','Max Mean','Min Valley','Max Peak' };
columnformat = {'numeric', 'numeric','numeric','numeric','numeric',...
       'numeric','numeric','numeric','numeric','numeric'};
columneditable = [false false false false false false false false false false];
%
sz=size(BIG);
%
for i = 1:sz(1)
    for j=1:sz(2)
           if(j==3)
               tempStr = sprintf('%10.1f', dat(i,j));
           else
               tempStr = sprintf('%8.4g', dat(i,j));
```

```
            end
            data_s{i,j} = tempStr;
    end
end
%
table1 = uitable('Units','normalized','Position',...
            [0.1 0.1 0.9 0.9], 'Data', data_s,...
            'ColumnName', columnname,...
            'ColumnFormat', columnformat,...
            'ColumnEditable', columneditable,...
            'RowName',[]);
%
end
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
%
fig_num=3;
figure(fig_num);
fig_num=fig_num+1;
if(ic==1)
    plot(y);
else
    plot(THM_hold(:,1),THM_hold(:,2));
end
grid on;
%
  figure(fig_num);
  fig_num=fig_num+1;
  h=bar(C);
  grid on;
  title('Rainflow Histogram');
  ylabel('Cycle Counts (n)');
  xlabel('Stress Range (\sigma)');
%
%
RB=BIG(:,1:3);
aaB=aa;
%
disp(' ');
disp(' Output arrays: ')
disp(' range_cycles  (range & cycles)');
disp('   amp_cycles  (amplitude & cycles)');
%
```

```
%%
% Calculate relative damage index tidak dihitung

disp(' ');
disp(' Calculate relative damage index?  1=yes 2=no ');
% ic=input(' ');
ic=2;
%
if(ic==1)
%
   disp(' ');
   disp(' Enter fatigue exponent ');
   b=input(' ');
%
   D=0;
   for i=1:kvn
      D=D+B(i,2)*(B(i,1)/2)^b;
   end
%
   out1=sprintf('\n D=%8.4g',D);
   disp(out1);
%
end
%
Bhold=B;
clear B;
%
disp(' ')
toc
```