

FRAUNHOFER INSTITUTE FOR MECHANICS OF MATERIALS

THOMAT COMPUTATIONAL PLATFORM

Status Report 2023-02

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The current status of the platform can be found in the subsequent tables.

Shortcuts:

CI: Cast iron
HCF: High cycle fatigue
TF: Thermal fatigue
Env: Environment
PP: Postprocessing
Win: Windows
Lin: Linux

Status:

Available: Tools/data are ready for download
Coming Soon: Tools/data are currently under construction
Planned: Tools/data that will be prepared next

01_MaterialData:

Material model parameter cards for cyclic plasticity and lifetime are available for the following materials.

Material	Ansys/Abaqus material cards: - Intrinsic, Intrinsic-CI (Abaqus only), ThoMat_OS - ThoMat_PP	Garofalo Creep
Al-based:		
EN-AW 2618A	Available	
Fe-based:		
EN GJL-150	Available	
EN GJL-250	Available	
EN GJL-300	Available	
EN GJV-400	Available	
EN GJV-450	Available	
EN GJS-700	Available	
EN GJS-500	Available	
Ni-based:		
Mar M247	Available	Available
Ti-Based:		

AI-based:

Material	Test_Type [-]	T_Min [degC]	T_Max [degC]	dT [K/s]	DEpsMech_Min [-]	DEpsMech_Max [-]	R_eps	dEpsMech_Max	t_Dwell at EpsMechMin [s]	t_Dwell at EpsMechMax [s]	Nf_Min [-]	Nf_Max [-]
01_EN-AW-2618A	CLCF	20	180	x	5.50E-03	3.20E-02	-1 / 0	1.00E-03	0	60	30	1.00E+05
01_EN-AW-2618A	IP-TMF	60-160	60-190	5	9.00E-03	1.70E-02	-infty	x	0	0	178	1763

Fe-based:

Material	Test_Type [-]	T_Min [degC]	T_Max [degC]	dT [K/s]	DEpsMech_Min [-]	DEpsMech_Max [-]	R_eps	dEpsMech_Max	t_Dwell at EpsMechMin [s]	t_Dwell at EpsMechMax [s]	Nf_Min [-]	Nf_Max [-]
02_GJV450	(C)LCF	20	500	x	4.00E-03	6.00E-03	-1	5 Hz	0	0	600	20500
02_GJV450	OP-TMF	50-400	50-450	10	4.00E-03	7.00E-03	-infy	x	0-60	0	231	6500
03_GJS700	(C)LCF	20	500	x	4.00E-03	1.00E-02	-1	5 Hz	0	0	300	20000
03_GJS700	OP-TMF	50-400	50-475	10	4.00E-03	7.50E-03	-infy	x	0-60	0	610	10000
04_GJS500	CLCF	20	500	x	6.00E-03	1.20E-02	-1	0.001 1/s	0	0	26	1568
04_GJS500	OP-TMF	50-350	50-500	5	7.00E-03	1.00E-02	-infy	x	0-300	0	78	309
05_GJL150	CLCF	20	800	x	2.00E-03	5.00E-03	-1	0.001 1/s	0-60	0	20	23800
05_GJL150	OP-TMF	200	700	5	3.00E-03	4.00E-03	-1	x	0	0	34	124
06_GJL250-2	CLCF	20	450	x	2.50E-03	6.00E-03	-1	0.001 1/s	0	0	60	94930
06_GJL250-2	OP-TMF	100	400	5	3.50E-03	6.00E-03	-infy	x	60	0	70	1470
07_GJL300	CLCF	20	450	x	2.50E-03	1.00E-02	-1	0.001 1/s	0	0	30	35070
07_GJL300	OP-TMF	100	400	5	4.00E-03	6.00E-03	-infy	x	60	0	59	6820

09_GJV400	CLCF	20	450	x	4.00E-03	7.00E-03	-1	0.001 1/s	0-60	0	284	7253
09_GJV400	OP-TMF	80-380	80-450	10	4.00E-03	5.00E-03	-infty	x	60	0	175	3795

Ni-based:

Material	Test_Type [-]	T_Min [degC]	T_Max [degC]	dT [K/s]	DEpsMech_Min [-]	DEpsMech_Max [-]	R_eps	dEpsMech_Max	t_Dwell at EpsMechMin [s]	t_Dwell at EpsMechMax [s]	Nf_Min [-]	Nf_Max [-]
Mar-M247	CLCF	20	1050	x	2e-3	1.2E-02	-1	1.00E-03 1/s	0	0	150	7.50E+04
Mar-M247	OP/IP-TMF	300-950	300-950	5	7.5E-03	1.2E-02	-1	x	0	0	100	2700

Material	Test_Type [-]	T_Min [degC]	T_Max [degC]	Sigma_Min [MPa]	Sigma_Max [MPa]	dEpsCr_Min [%/h]	dEpsCr_Max [%/h]
Mar-M247	Creep	700	1000	25	700	-1e-5	0.02

02_VideoTutorials:

Video Tutorials and supplementary material are available for the following topics.

Topic	Video	Supplementary Material
Introduction and high temperature laboratory	Available	Available
Cyclic plasticity models:		
Model equations	Available	Available
Model equations - CastIron	Planned	Available
Material cards - Abaqus	Available	Available
Material cards - Ansys	Available	Available
Fracture Mechancis and Lifetime Concepts:		
Model equations - DTMF	Available	Available
Model equations - Crack Closure	Available	Available
Model equations - HCF & TF	Planned	Available
Model equations - DTMF-Brittle	Available	Available
Model equations - DTMF-Env	Planned	Available
Material card	Available	Available
Model Application:		
Abaqus	Available	Available
Ansys	Available	Available
Remarks	Available	Available

03_FEM-Examples:

The following FEM examples are available on the platform.

FEM Example:	Abaqus	Ansys
Single element LCF/TMF: Intrinsic/PP	Available	Available
Single element LCF/TMF: ThoMat_OS/PP	Available	Available

05_FEM-Tools:

The following COMPILED ThoMat computational software tools for the respective releases are available on the platform.

Source code is always available!

Abaqus Release	ThoMat_OS	ThoMat_PP* DTMF-based
Win:		
2017	Available	Coming Soon
2018	Coming Soon	Coming Soon
2019	Coming Soon	Coming Soon
2020	Coming Soon	Coming Soon
2021	Coming Soon	Coming Soon
Linux:		
2017	Coming Soon	Available
2018	Coming Soon	Coming Soon
2019	Coming Soon	Coming Soon
2020	Coming Soon	Available
2021	Coming Soon	Coming Soon

<u>Ansys</u>	<u>ThoMat OS</u>	<u>ThoMat PP* DTMF-based + User01 + ACT</u>
Win:		
	Available	Available

*ThoMat_PP includes the lifetime evaluation for:

- CC-models: Heitmann, Newman, modified Newman, Affeldt
- Damage parameter: D_{TMF} , $D_{TMF,brittle}$

Coming Soon:

- Extension of ThoMat_PP including $D_{TMF,env}$
- Additional postprocessing tool for the lifetime estimation in thermomechanically loaded gradient fields for Abaqus.
- Possibility for damage accumulation D_{ACC} to account for subcycles connected to rainflow counting algorithm.