

3. 疲劳

3.1 疲劳

疲劳

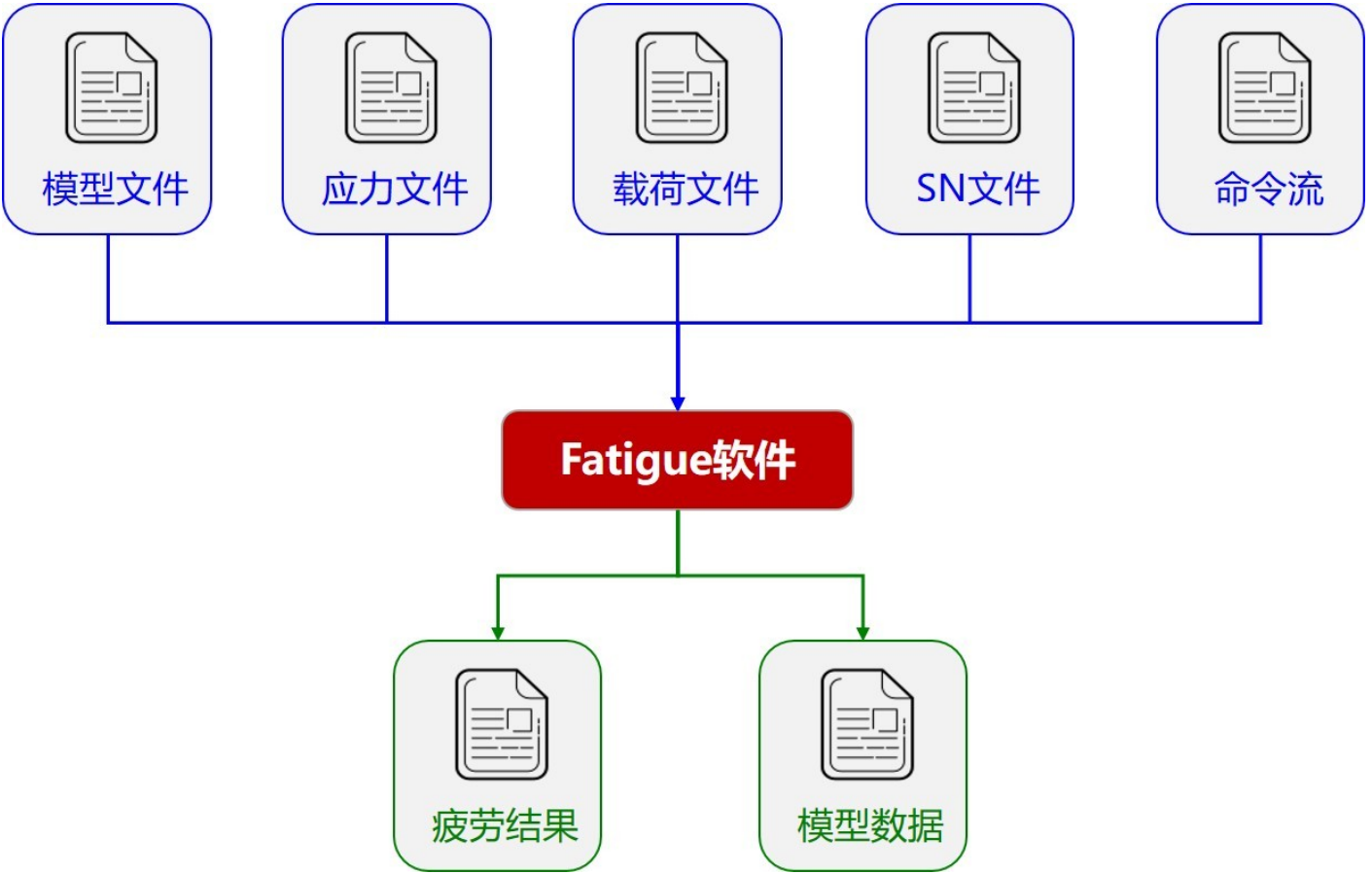
疲劳

- 1. 疲劳
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11. SN
- 12.

疲劳

3. 疲劳

MATLAB SN



3.1 Fatigue

3.2

ANSYS mesh CDB ABAQUS inp

- ABAQUS C3D20 C3D10 C3D4 S8R S3 S4 CPS3 SPRINGA COMBIN14 CPE4 MASS ROTARYI
- ANSYS SOLID186 SOLID187 SURF154 STRI65 SURF153 PLANE182


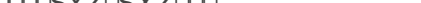

Fatigue ANSYS ABAQU

- Translating ANSYS input files to partial Abaqus input files
- ABAQUS Element Types Supported by FE Modeler

3.3

σ_{xx} σ_{yy} σ_{zz} σ_{xy}

COMMENTS	LINE						
	NODE	SX	SY	SZ	SXY	SYZ	SXZ
	1	3. 7834	0. 26638	0. 0000	- 0. 3E- 01	0. 0000	0. 0000

- SYZSXZ
- 
- **Fatigue** 

3.4

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SON





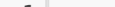


```
"LoadCase1": {
  "repeats": 2000.0,
  "components": {
    "Fx": {
      "scale": 1.0,
      "data": [50.0, 52.5, 54.9, ... ],
      "unit": "N",
      "offset": 0.0
    },
    "Time": {
      "scale": 1.0,
      "data": [0.0, 0.1, 0.2, ... ],
      "unit": "s",
      "offset": 0.0
    }
  }
},
"LoadCase2": {
  "repeats": 2000000.0,
  "components": {
    "Fx": {
      "scale": 1.0,
      "data": [50.0, 52.5, 54.9, ... ],
      "unit": "N",
      "offset": 0.0
    },
    "Time": {
```

```

    "scale": 1.0,
    "data": [0.0, 0.1, 0.2, ... ],
    "unit": "s",
    "offset": 0.0
  }
}
}

```

☐ ☐ ☐ ☐ ☐ ☐

- LoadCase1 LoadCase2 LoadCase1 LoadCase2 
- LoadCase1 repeats 
- components 
- Fx  Fx  Fx 
- scale data unit offset **Fatigue** 

3.5 S-N

S-NSON

```
"Header": {
  "author": "Pan Xiao",
  "description": "default test material"
},

"Density": {
  "value": 7800.0
},

"Elasticity": {
  "youngthModulus": 200.0,
  "poissonRatio": 0.3
},

"Fatigue": {
  "style": "custom",
  "comments": "default SN curve from fatlab",
  "sn": {
    "slope1": 3.0,
```

```
        "slope2": 5.0,
        "fatigueStrength": 100.0,
        "associatedCycles": 2000000,
        "kneePointStress": 43.3188,
        "kneePointCycles": 10000000,
        "stressMin": 0.0,
        "stressMax": 1000.0,
        "safetyFactor": 1.35,
        "allowableDamage": 1.0
    },
    "meanStress": {
        "mode": "None",
        "sensitivity": 0.2,
        "yieldStrength": 235.0,
        "tensileStrength": 370.0,
        "avoidYielding": 0,
        "extrapolateInCompression": 0
    }
}
```

2.3 材料属性

名称	单位	描述
Header/author	字符串	作者名称
Header/description	字符串	描述
Density/value	字符串	密度
Elasticity/youngthModulus	ES	弹性模量
Elasticity/poissonRatio	μ	泊松比
Fatigue/style	字符串	疲劳曲线类型custom
Fatigue/comments	字符串	疲劳曲线注释
Fatigue/sn	sn	SN曲线
sn/slope1	m_1	SN曲线斜率1
sn/slope2	m_2	SN曲线斜率2
sn/fatigueStrength	$\Delta \sigma_{R1}$	疲劳强度MPa
sn/associatedCycles	N_{R1}	疲劳寿命
sn/kneePointStress	$\Delta \sigma_{R2}$	疲劳强度 m_1 m_2 MPa

変数名	単位	説明
sn/kneePointCycles	N_{R2}	曲げ点のサイクル数
sn/stressMin	$\Delta \sigma_{Rmin}$	最小応力変動 (MPa)
sn/stressMax	$\Delta \sigma_{Rmax}$	最大応力変動 (MPa)
sn/safetyFactor	γ_{Mf}	安全係数 ≥ 1
sn/allowableDamage	D_a	許容損傷 ≥ 1
Fatigue/meanStress		平均応力
meanStress/mode	モード	平均応力の考慮方法: none, linear, bilinear, modified-goodman, gerber-parabola, smith-watson-topper, 60-compression, iiw-low-rs, iiw-medium-rs, fkm
sensitivity	M	感度
yieldStrength	σ_y	降伏点応力
tensileStrength	σ_u	引張強さ
avoidYielding		降伏を回避する (0: 否, 1: 是)
extrapolateInCompression		圧縮領域に外挿する (0: 否, 1: 是)

3.6 疲労

Fatigue 疲労

- **Fatigue** 疲労
- **Fatigue**
- **Fatigue**

Fatigue 疲労 “input log”

Fatigue:

Fatigue [options]

Fatigue

- filename : **Fatigue**
- -in filename : **Fatigue**
- -log filename : **Fatigue**
- -title TitleString : **Fatigue** “\${Title}”
- -var vName vValue : **Fatigue** variable

3.7

Fatigue

- `Fatigue filename.scf`
- `Fatigue -in filename.scf` **Fatigue**
- `input filename.scf`

Fatigue

1. **Fatigue** **Fatigue** "S"
2. **Fatigue** " #" " #"
3. **Fatigue** input, output, mesh, material, loads, life Action Options
4. 3 out outp outpu output
5. **Fatigue** " ="
- 6.

Fatigue

-

variable

-

input , output

-

mesh

-

material

-

loads

-

life



Fatigue

```
output settings Definition

title      = "${Script}"
input      -echo both
output     log ${title}.log -debug yes

model data

ash read model Bolted_joint/model.txt -style ansys -surface 3d
ash write model Bolted_joint/model -style tetgen

material data

ater read steel0 sn-steel0.json

loads data

oads read cases Bolted_joint/loads.json -style json
oads read stress sPret 1d-linear Pret 1.0 Bolted_joint/Pret.fes -style ansys
oads read stress sF5 1d-bilinear F5 -1.0 Bolted_joint/F5-100kN.fes -style ansys
oads read stress sF5 1d-bilinear F5  1.0 Bolted_joint/F5+100kN.fes -style ansys
oads read stress sF6 1d-bilinear F6 -1.0 Bolted_joint/F6-100kN.fes -style ansys
oads read stress sF6 1d-bilinear F6  1.0 Bolted_joint/F6+100kN.fes -style ansys

life run

ife set surface -mat steel0 -smode pnmax -cmode rainflow
ife run -report 10
ife export Bolted_joint/result-pnmax.txt -style text
ife export Bolted_joint/result-pnmax -style tetgen
```

3.8

Number Node Dtot UR Napplied Nendurable dSeq dSmax Smax Smin

1 8509 0.000163 0.0547 8.25e+06 5.034e+10 2.527 11.041 5.828 -5.2134

2 8510 7.9972e-06 0.0199 3.75e+06 4.6892e+11 1.2013 6.0441 -8.2466 -14.291

.....

XXXXXXXXXX

Number	Node	Dtot	UR	Napplied	Nendurable	dSeq	dSmax	Smax	Smin
1	8509	0.000163	0.0547	8.25e+06	5.034e+10	2.527	11.041	5.828	-5.2134
2	8510	7.9972e-06	0.0199	3.75e+06	4.6892e+11	1.2013	6.0441	-8.2466	-14.291
.....									

Revision #3

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