

3. 疲劳

3.1 疲劳

疲劳

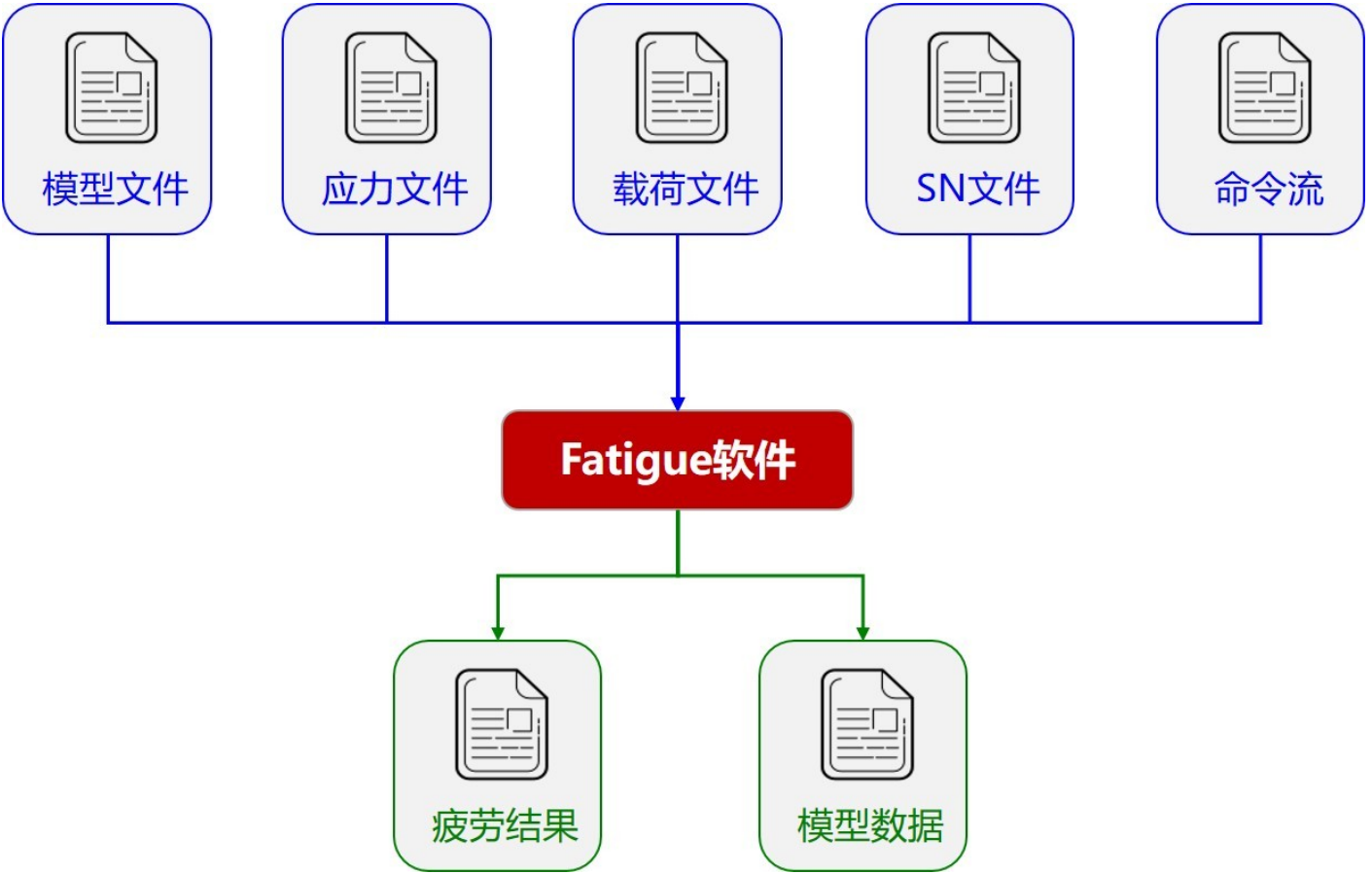
疲劳

- 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


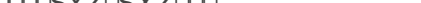

Fatigue ANSYS ABAQU

- 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

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

SON





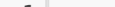


```
"LoadCase1": {
  "repeats": 2000.0,
  "components": {
    "Fx": {
      "scale": 1.0,
      "data": [50.0, 52.5, 54.9, ... ],
      "unit": "N",
      "offset": 0.0
    },
    "Time": {
      "scale": 1.0,
      "data": [0.0, 0.1, 0.2, ... ],
      "unit": "s",
      "offset": 0.0
    }
  }
},
"LoadCase2":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

```

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- 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

| 属性名 | 单位 | 说明 |
|---------------------------|----------------------|----------------------------|
| Header/author | 字符串 | 作者信息 |
| Header/description | 字符串 | 描述信息 |
| Density/value | 字符串 | 密度值 |
| Elasticity/youngthModulus | ES | 弹性模量 |
| Elasticity/poissonRatio | μ | 泊松比 |
| Fatigue/style | 字符串 | 疲劳曲线风格，支持custom |
| Fatigue/comments | 字符串 | 疲劳曲线注释 |
| Fatigue/sn | sn | 疲劳曲线编号 |
| sn/slope1 | m_1 | 疲劳曲线斜率1 |
| sn/slope2 | m_2 | 疲劳曲线斜率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 拐点强度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

Created 8 May 2023 02:28:58 by Pan

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