

## SZLZ102 - Tiredness with various methods of counting

---

### Summary:

This test relates to the methods of countings of cycles (RAINFLOW, RCCM) starting from a history of loading in constraints.

Starting from a simple history of loading defined by `DEFI_FONCTION`, one extracts the elementary cycles by the method of counting of cycles of the RAINFLOW [R7.04.01], then by the method of counting of cycles RCCM [R7.04.01].

One also tests the taking into account of the coefficient of stress concentration  $K_T$ .

This example is a test of validation of software POSTDAM developed by Department REME, provided in the Manuel de Validation of version 1.0 of this software.

Results provided by the operator `POST_FATIGUE` are completely identical to those provided by software POSTDAM.

## 1 Problem of reference

---

### 1.1 Geometry

The analysis consists in extracting the elementary cycles starting from a history from loading in constraints.

- First call to POST\_FATIGUE :

One extracts the elementary cycles by the method of counting of cycles RAINFLOW, on the history of loading  $\sigma_1(t)$ .

- Second call to POST\_FATIGUE :

One extracts the elementary cycles by the method of counting of cycles RCCM, on the history of loading  $\sigma_1(t)$ .

- Third call to POST\_FATIGUE :

One extracts the elementary cycles by the method of counting of cycles RAINFLOW, on the history of loading  $\sigma_2(t)$  and one uses a coefficient of stress concentration  $K_T=2$ .

- Fourth call to POST\_FATIGUE :

One extracts the elementary cycles by the method of counting of cycles RCCM, on the history of loading  $\sigma_2(t)$  and one uses a coefficient of stress concentration  $K_T=2$ .

#### History of the loading

$t$	0.	1.	2.	3.	4.	5.	6.	7.	8.
$\sigma_1(t)$	0.	500.	200.	400.	300.	500.	-300.	200.	-500.
$t$	0.	1.	2.	3.	4.	5.	6.	7.	8.
$\sigma_2(t)$	0.	250.	100.	200.	150.	250.	-150.	100.	-250.

## 2 Reference solution

### 2.1 Method of calculating used for the reference solution

This test is resulting from the handbook of validation of software POSTDAM version 1.0. The reference solutions are given in this document.

### 2.2 Results of reference

- **First call** with POST\_FATIGUE : method RAINFLOW from  $\sigma_1(t)$

Nb_Cycl = 4	Cycle 1	Vale_Min:	300.	Vale_Max:	400.
	Cycle 2	Vale_Min:	200.	Vale_Max:	500.
	Cycle 3	Vale_Min:	- 300.	Vale_Max:	200.
	Cycle 4	Vale_Min:	- 500.	Vale_Max:	500.

- **Second call** with POST\_FATIGUE : method RCCM from  $\sigma_1(t)$

Nb_Cycl = 5	Cycle 1	Vale_Min:	- 500.	Vale_Max:	500.
	Cycle 2	Vale_Min:	- 300.	Vale_Max:	500.
	Cycle 3	Vale_Min:	0.	Vale_Max:	400.
	Cycle 4	Vale_Min:	200.	Vale_Max:	300.
	Cycle 5	Vale_Min:	88.8889	Vale_Max:	200.

- **Third call** with POST\_FATIGUE : method RAINFLOW from  $\sigma_2(t)$  with  $K_T=2$ .

(Results identical to the first call to POST\_FATIGUE since a loading is taken  $\sigma_2(t)=1/2\sigma_1(t)$ , then one multiplies the history of loading by a coefficient of stress concentration  $K_T=2$ .)

Nb_Cycl = 4	Cycle 1	Vale_Min:	300.	Vale_Max:	400.
	Cycle 2	Vale_Min:	200.	Vale_Max:	500.
	Cycle 3	Vale_Min:	- 300.	Vale_Max:	200.
	Cycle 4	Vale_Min:	- 500.	Vale_Max:	500.

- **Fourth call** with POST\_FATIGUE : method RCCM from  $\sigma_2(t)$  with  $K_T=2$ .

(Results identical to the second call to POST\_FATIGUE since a loading is taken  $\sigma_2(t)=1/2\sigma_1(t)$ , then one multiplies the history of loading by a coefficient of stress concentration  $K_T=2$ .)

Nb_Cycl = 5	Cycle 1	Vale_Min:	- 500.	Vale_Max:	500.
	Cycle 2	Vale_Min:	- 300.	Vale_Max:	500.
	Cycle 3	Vale_Min:	0.	Vale_Max:	400.
	Cycle 4	Vale_Min:	200.	Vale_Max:	300.
	Cycle 5	Vale_Min:	88.8889	Vale_Max:	200.

### 2.3 Uncertainty on the solution

Analytical solution.

### 2.4 Bibliographical references

1.Handbook of validation of POSTDAM version 1.0. Baker I., Vatin E. HP - 14/93/016B

## 3 Modeling A

---

### 3.1 Sizes tested and results

Identification		Reference
First call to POST_FATIGUE		
and Third call to POST_FATIGUE		
<hr/>		
NB_CYCL		4.
Cycle 1	VALE_MIN	300.
	VALE_MAX	400.
Cycle 2	VALE_MIN	200.
	VALE_MAX	500.
Cycle 3	VALE_MIN	-300.
	VALE_MAX	200.
Cycle 4	VALE_MIN	-500.
	VALE_MAX	500.
<hr/>		
Second call to POST_FATIGUE		
and Fourth call to POST_FATIGUE		
<hr/>		
NB_CYCL		5.
Cycle 1	VALE_MIN	-500.
	VALE_MAX	500.
Cycle 1	VALE_MIN	-300.
	VALE_MAX	500.
Cycle 1	VALE_MIN	0.
	VALE_MAX	400.
Cycle 1	VALE_MIN	200.
	VALE_MAX	300.
Cycle 1	VALE_MIN	88.8889
	VALE_MAX	200.

## 4 Summary of the results

---

Results of *Code\_Aster* are identical to the values of reference provided in the handbook of validation of version 1.0 of POSTDAM.