

Problem 1: Tension Rod

Objectives:

- 1. Understand the difference between Lagrangian and Eulerian kernels
- 2. Evaluate the mechanism of bond failure and failure criteria
- 3. Observe tension instability in Eulerian kernel

To-do list:

You are expected to do the following studies by **Beta**:

- 1. Create a new directory under Example 1 & copy *input_rodten.k*
- 2. Obtain the results by setting KERNEL=0, FS=1E+90
- 3. Create another directory and copy *input_rodten.k*
- 4. Obtain the results by setting KERNEL=0, FS=0.2
- 5. Create another directory and copy *input_rodten.k*
- 6. Obtain the results by setting KERNEL=1, FS=1E+90
- 7. Create another directory and copy *input_rodten.k*
- 8. Obtain the results by setting KERNEL=1, FS=0.2
- 9. Create another directory and copy *input_rodten.k*
- 10. Obtain the results by setting KERNEL=1, FS=0.05
- 11. Compare the deformation and reaction forces

Ø6.4x53.3mm (Diameter linearly reduced to 98.2% at mid-length) 6061-T6 Johnson-Cook w/o dmg

> Input file: *input_rodten.k* 100X mass in simulation

BCs:

YXX

Constant velocity longitudinally at two ends while circumferentially constrained

Major Keywords for Rod Tension (By Default, TSSFAC=0.9 and ITB=1)

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Keyword								Remark	
*SE \$# \$# \$	CTION_SOL secid 1 DX 1.6 IDAM 1	LID_SPG elform 47 DT 1.6 FS 1.0E+90	aet 9 DZ 1.6 STRETCH 1.10	ISPLINE 0 ITB 1	KERNEL B	LSCALE 0.0	SMSTEMP 30	SWTIME 0.0	Updated Lagrangian kernel FS=1E+90 To see non-failure response
*SE \$# \$# \$	CTION_SOL secid 1 DX 1.6 IDAM 1	.ID_SPG elform 47 DT 1.6 FS 0.2	aet 0 DZ 1.6 STRETCH 1.10	ISPLINE 0 ITB 1	KERNEL Ø	LSCALE 0.0	SMSTEMP 30	SWTIME 0.0	Updated Lagrangian kernel FS=0.2 To see failure due to specified criterion
*SE \$# \$# \$	CTION_SOL secid 1 DX 1.6 IDAM 1	.ID_SPG elform 47 DT 1.6 FS 1.0E+90	aet 0 DZ 1.6 STRETCH 1.10	ISPLINE 0 ITB 1	KERNEL	LSCALE 0.0	SMSTEMP 30	SWTIME 0.0	Eulerian kernel FS=1E+90 To see tension instability
*SE \$# \$# \$	CTION_SOU Secid 1 DX 1.6 IDAM 1	-ID_SPG elform 47 DT 1.6 FS 0.2	aet 0 DZ 1.6 STRETCH 1.10	ISPLINE 0 ITB 1	KERNEL	LSCALE 0.0	SMSTEMP 30	SWTIME 0.0	Eulerian kernel FS=0.2 To see tension instability (improper criterion)
*SE \$# \$# \$	CTION_SOL secid 1 DX 1.6 IDAM 1	ID_SPG elform 47 DT 1.6 FS 0.05	aet Ø DZ 1.6 STRETCH 1.82	ISPLINE 0 ITB 1	KERNEL	LSCALE 8.0	SMSTEMP 30	SWTIME 0.0	Eulerian kernel FS=0.05 To see failure due to specified criterion



Reaction Force in Rod Tension



Legend: Lag: Lagrangian kernel

Eul: Eulerian kernel NoF: No failure is applied F0.2: Failure at eps=0.2 F0.05: Failure at eps=0.05 eps: effective plastic strain



Effective Plastic Strain at Failure Initiation



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