Pseudo Arclength Methods in MOOSE

April 13, 2017

MOOSE

1. Multiphysics Object Oriented Simulation Environment
2. Massively Parallel
3. Implement Arclength Method in MOOSE

Pseudo Arclength Method

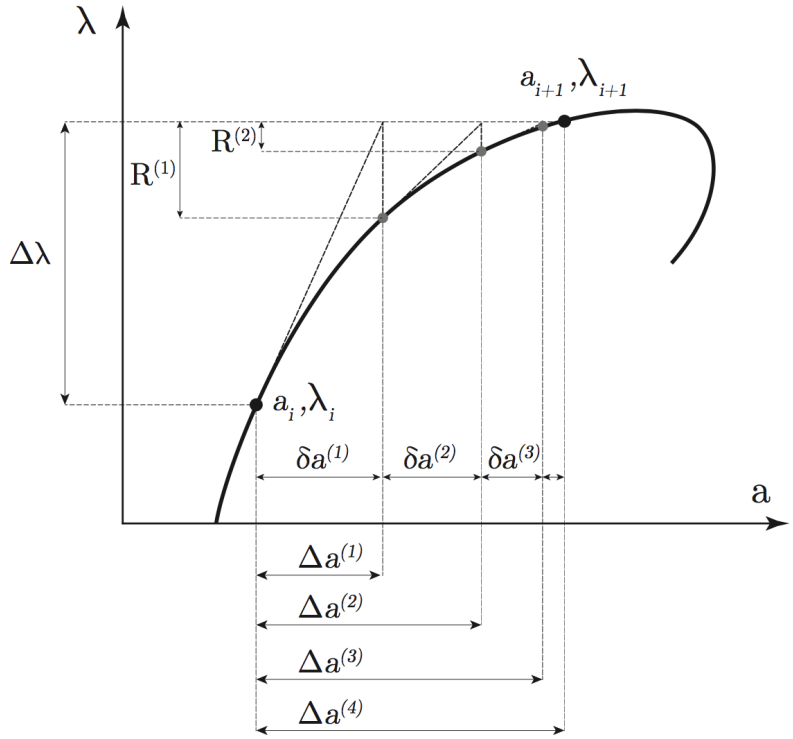


Figure: Schematic for Pseudo Arc Length Method [1]

Linearized Pseudo Arclength Method

$$G(u,\lambda) = (u - u_{old})\frac{\partial u}{\partial s}\Big|_{s_i} + (\lambda - \lambda_{old})\frac{\partial \lambda}{\partial s}\Big|_{s_i} - radius$$

Initialization:

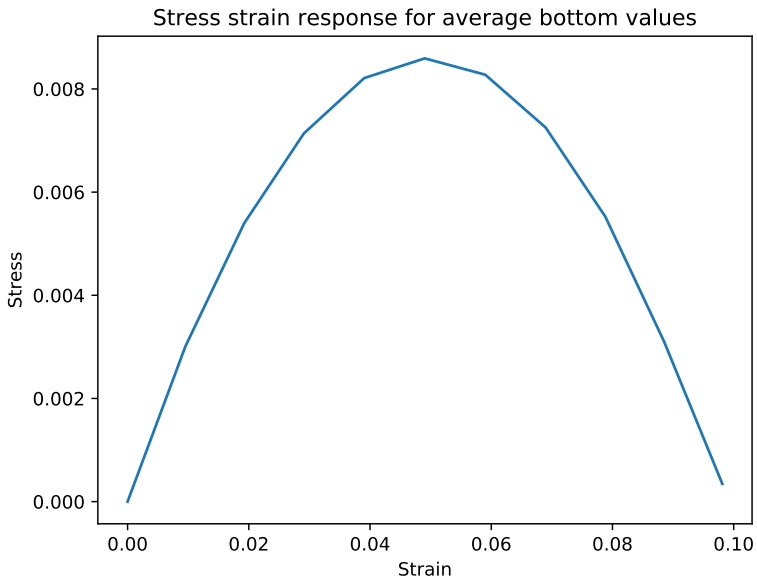
$$\frac{\partial \lambda}{\partial s}\Big|_{s_0} = \frac{1}{\sqrt{2}}$$

$$\frac{\partial u}{\partial \lambda}\Big|_{s_0} \approx \frac{u_1 - u_0}{\lambda_1 - \lambda_0}$$

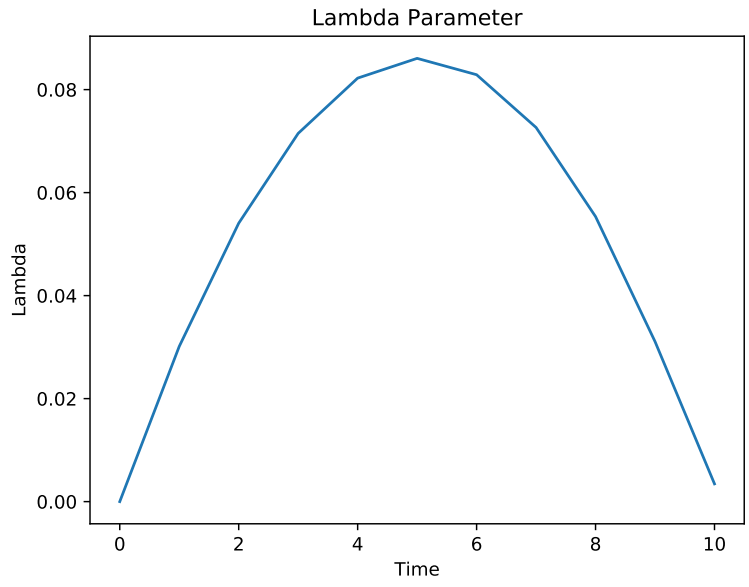
$$\frac{\partial u}{\partial s}\Big|_{s_0} = \frac{\partial \lambda}{\partial s}\Big|_{s_0}\frac{u_1 - u_0}{\lambda_1 - \lambda_0}$$

$$\Delta s = \frac{\lambda_1 - \lambda_0}{\frac{\partial \lambda}{\partial s}\Big|_{s_0}}$$

Results


Stress strain response for average bottom values
Stress
Strain
0.000
0.002
0.004
0.006
0.008
0.00
0.02
0.04
0.06
0.08
0.10

(a)


Lambda Parameter
Lambda
Time
0.00
0.02
0.04
0.06
0.08
0
2
4
6
8
10

(b)

Coupling Damage with Phase Field

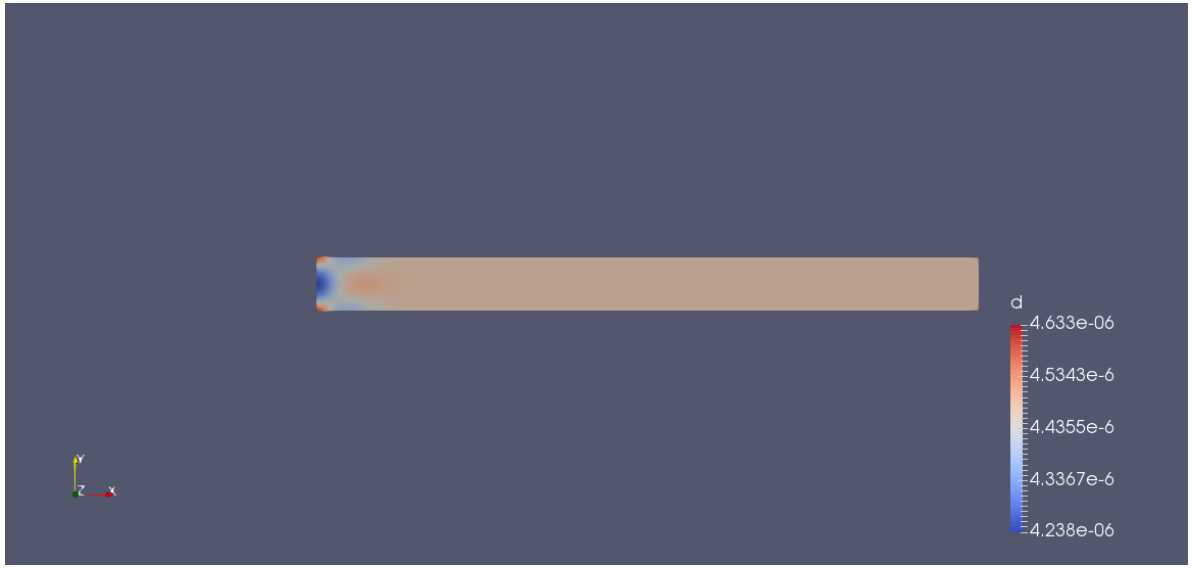


Figure: Bar under tension with dirichlet BC on left. No softening.


A. G. Salinger, N. M. Bou-Rabee, R. P. Pawlowski, E. D. Wilkes, E. A. Burroughs, R. B. Lehoucq, and L. A. Romero. Sand2002-0396: Loca 1.0 library of continuation algorithms: Theory and implementation manual. Technical report, Sandia National Laboratories, Albuquerque, NM, 2002.


https://github.com/idaholab/moose