Cgsm User's Guide : An Overture Solver for the Solving the Equations of Solid Mechanics,

William D. Henshaw

Department of Mathematical Sciences,
Rensselaer Polytechnic Institute,
Troy, NY, 12180,
www.overtureFramework.org

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1 Nomenclature

ρ	density	(1)
u_i	displacement vector	(2)
ϵ_{ij}	strain tensor	(3)
τ_{ij}	stress tensor	(4)
λ	shear modulus, Lamé constant	(5)
μ	Lamé constant	(6)

2 Introduction

2.1 Basic steps

3 Sample command files for running cgsm

4 Options and parameters

5 User defined functions

6 Hints for running

7 Frequently ask questions

8 Governing Equations

See [1].

The equations of linear elasticity for a homogeneous isotropic material are governed by

$$\rho \partial_t^2 u_i = \partial_{x_j} \tau_{ij} + \rho f_i \tag{7}$$

$$\tau_{ij} = \lambda \partial_{x_k} u_k \delta_{ij} + 2\mu \epsilon_{ij} \tag{8}$$

$$\epsilon_{ij} = \frac{1}{2}(\partial_{x_j} u_i + \partial_{x_i} u_j) \tag{9}$$

or

$$\rho \partial_t^2 u_i = (\lambda + \mu) \partial_{x_i} \partial_{x_k} u_k + \mu \partial_{x_k}^2 u_i + \rho f_i \tag{10}$$

$$\rho \mathbf{u}_{tt} = (\lambda + \mu) \nabla(\nabla \cdot \mathbf{u}) + \mu \Delta \mathbf{u} + \rho \mathbf{f} \tag{11}$$

8.1 Boundary conditions

References

[1] D. Appelö, J. W. Banks, W. D. Henshaw, and D. W. Schwendeman, *Numerical methods for solid mechanics on overlapping grids: Linear elasticity*, J. Comput. Phys., 231 (2012), pp. 6012–6050. publications/AppeloBanksHenshawSchwendemanSmog2012.pdf.