

Computational Structural Mechanics

ADM Algorithm

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ADM Algorithm

- **Equation to be solved**

- Ref. Eqn. 33, H. W. Brown III, *Analysis of Axisymmetric Micromechanical Concentric Cylinder Model*, Air Force Wright Laboratory, Materials Directorate, WPAFB, OH.

$$L_1 x' + L_0 x = y$$

- **Current solution method**

- Assemble L_1 and L_0 (SCTN), shuffle into desired form (SCTN2), and compute all eigenvalues and eigenvectors (EIGEN).
O(N³) operation
- Construct matrix and RHS vector representing the field equations (Eqn. 52) for each section and solve for constant coefficients.

$$F c = v$$

where F is obtained by evaluating functions involving $e^{\lambda z}$.

- Note the error associated with the eigenvalue estimates is thus amplified, necessitating the use of 128-bit precision floating point operations

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- **Alternate solution method**
 - Employ an iterative solver algorithm such as Runge-Kutta.
 - Utilize a standard library package (e.g. ODE) made available at Netlib.
- **Reduced sensitivity to error**
 - Produces a numerical estimate for x “directly”
 - Eliminates evaluation of exponential eigenvalue functions.
- **Restart feature sacrificed**
 - Reasonable cost for developing a portable code.
- **Potential for performance improvement**
 - Replacing 128-bit floating point performed in software with 64-bit hardware instructions will yield a 100-fold improvement in run times on H-P Exemplar.

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- **Basic requirements (ASC view)**
 - Identify and isolate linear structures associated with L_1 , L_2 , x , and y .
 - Patch library source into 128-bit code for validation purposes.
 - Modify post-processing routines as required.
 - Validate and benchmark new code
 - AFRL inputs
- **Proposed ASC contributions**
 - Identify appropriate library routines and write example code.
 - Collaborate on validation and benchmarking effort.
 - Produce portable 64-bit version.
- **Proposed AFRL contributions**
 - Isolate linear components.
 - Make all downstream modifications.
 - Collaborate on initial 128-bit version of modified code.

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- **What we need**
 - PET proposal describing collaborative project.
 - Approval of FTEs for PT/ES and CSM to proceed.
 - Commitment to mutually agreeable schedule.