Development of a Nonlinear Finite Element Program for Seismic Analysis of Simple Structures

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April 20th, 2005

Goals

- Prediction of behaviour of complex structures under various loads

- Flexible analysis framework

- Control of entire modelling process

Method

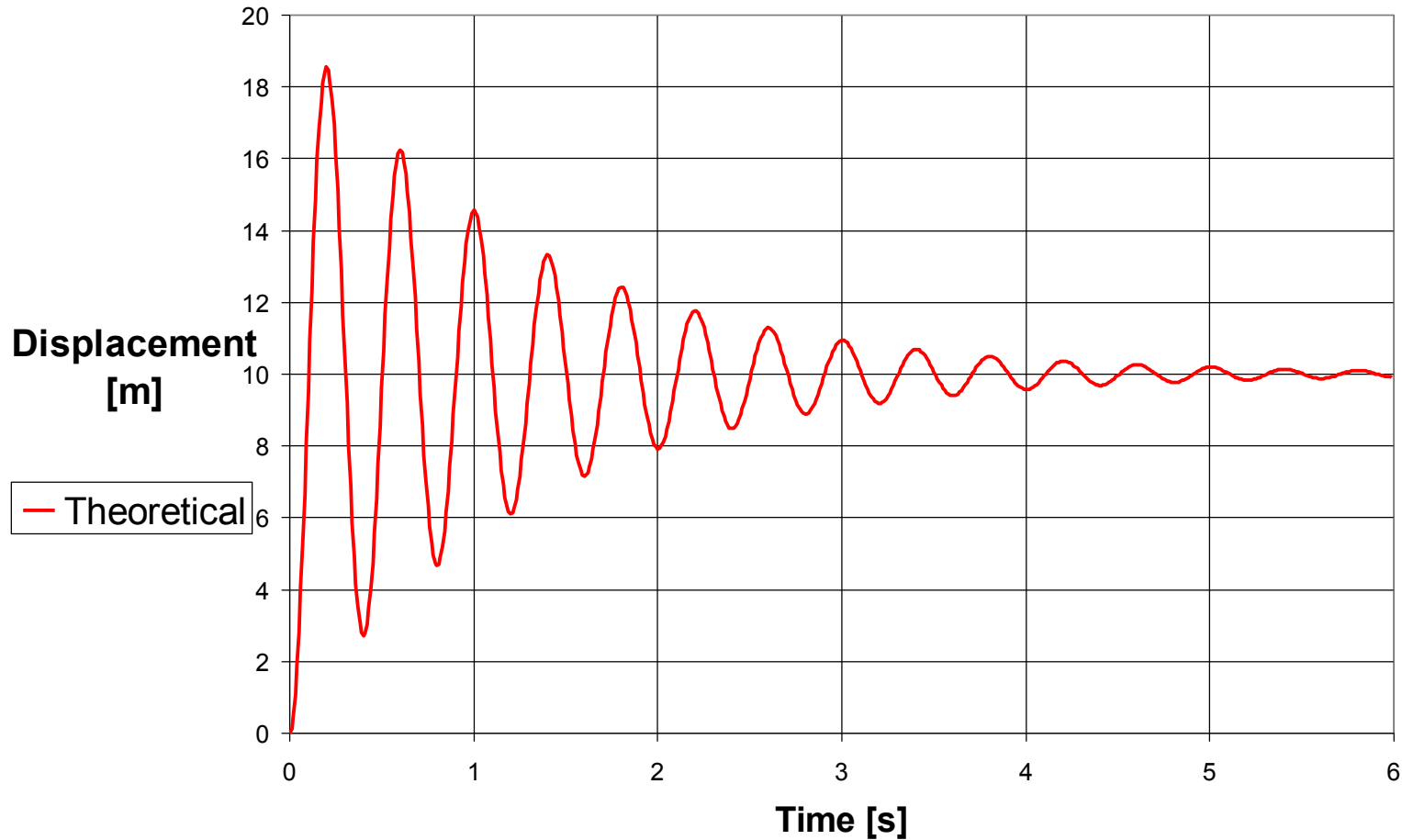Develop Finite Element Method (FEM) program

Develop and validate a non linear plastic hinge element

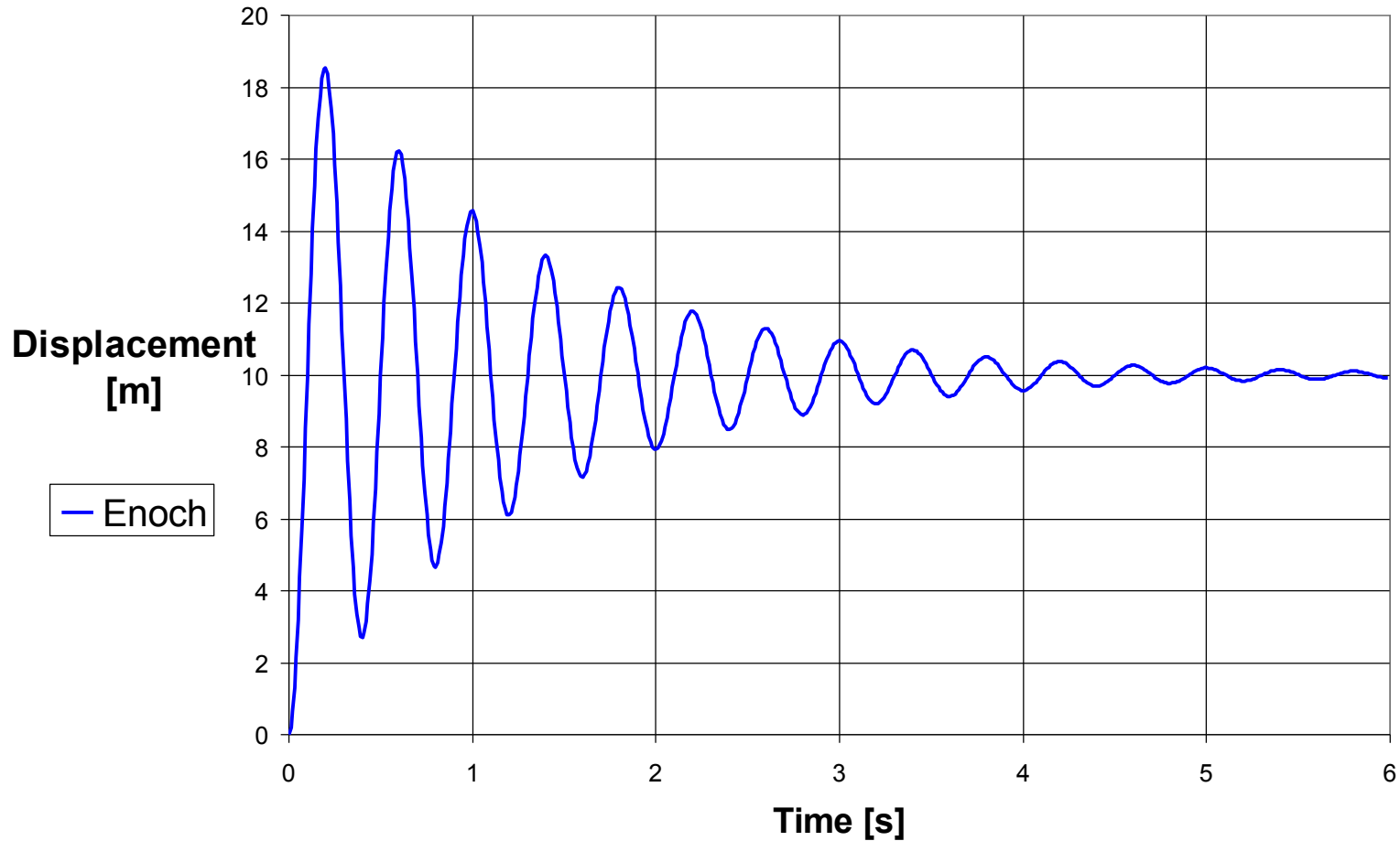Model non linear behaviour of a multi story structure

FEM Validation

- Linear, SDOF system

- Constant, instantaneous load

- Calculated and theoretical responses compared
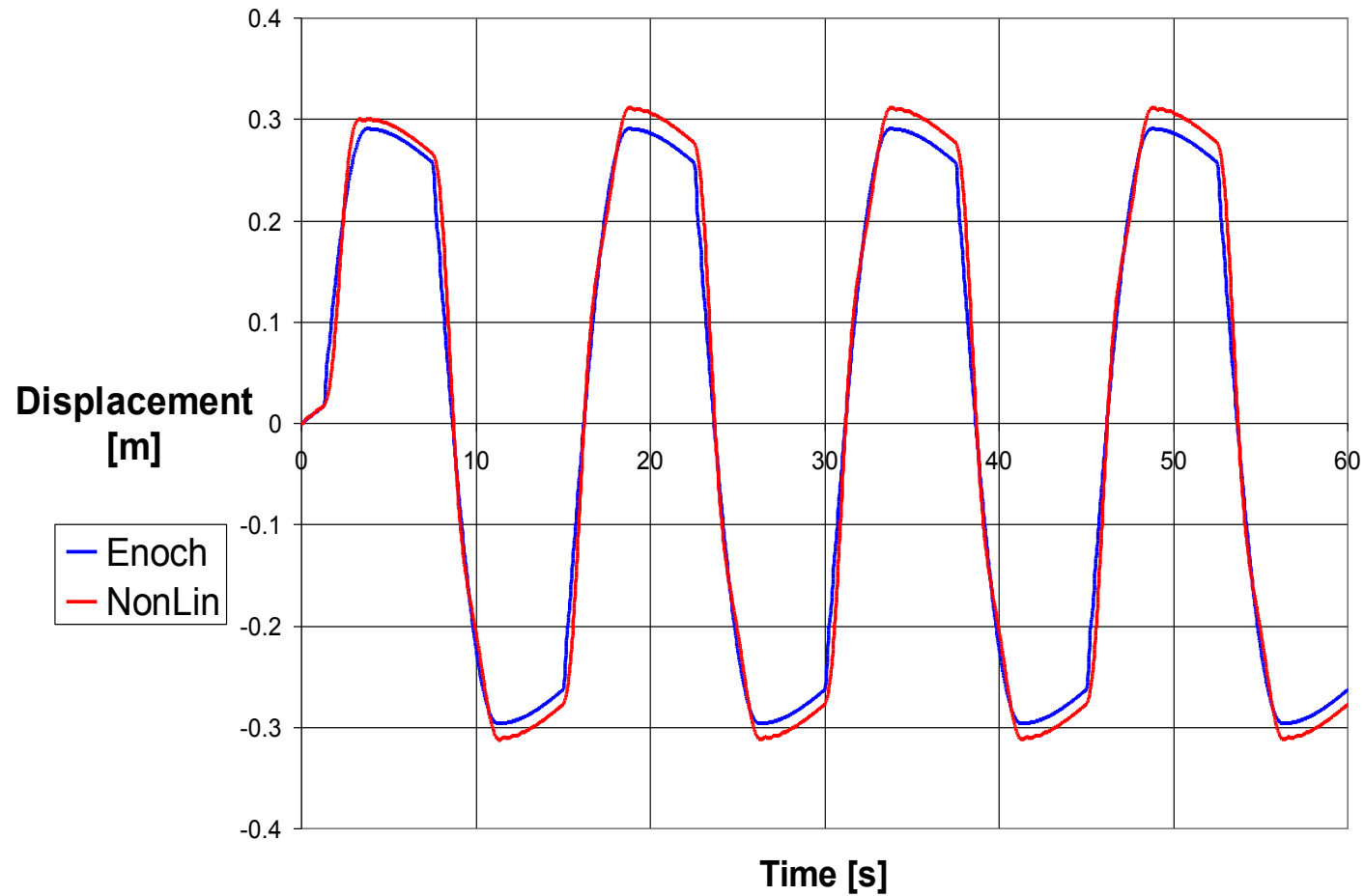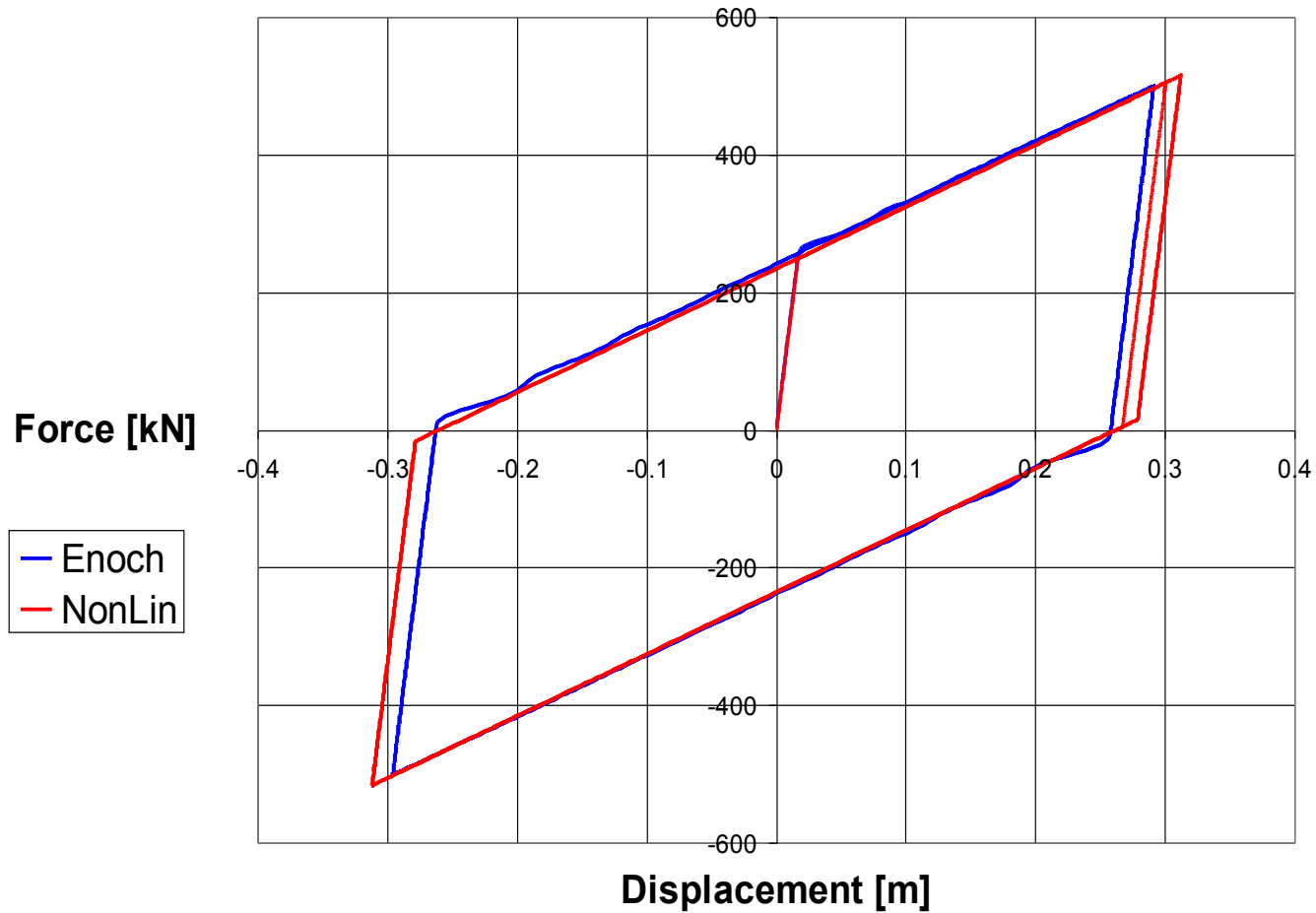
FEM Validation

FEM Validation

Plastic Hinge Validation

- SDOF system

- Monotonic loading

  - Expected response observed

- Cyclic loading compared to NonLin

  - Excellent correlation
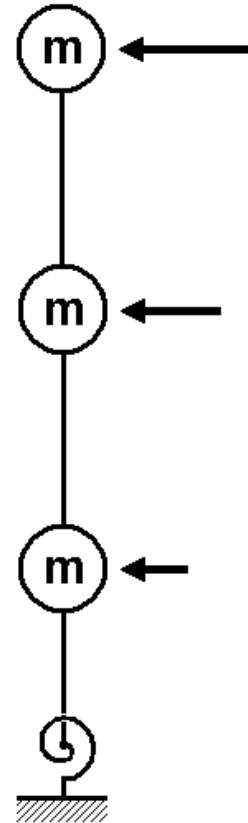
Plastic Hinge Validation
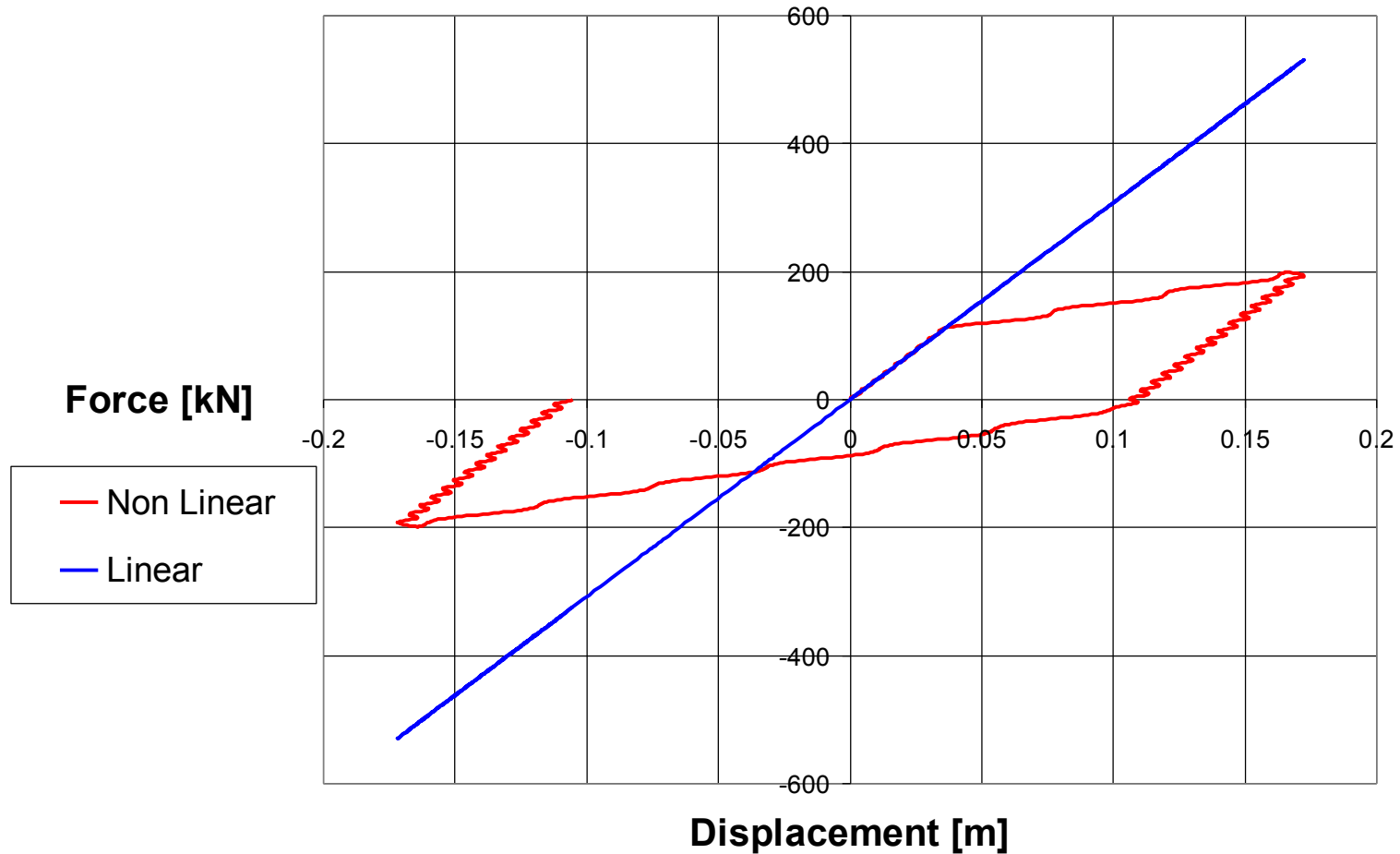
Plastic Hinge Validation

Shear Wall Response

- Three story structure

  - Equal masses and story stiffness

  - Plastic hinge at base

- Push-pull analysis

  - Single linear cycle

Shear Wall Response

Limitations

- Enoch does not check units

- Damping sometimes causes convergence problems

- Validation is time-consuming

- Flexibility increases complexity

Conclusions

- Enoch analysis of linear and non linear systems is accurate

- Plastic hinge behaves as expected

- Writing custom FEM software is a feasible option

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