Imperial College
London

AE3-422
High-Performance Computing

Assignment

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Description

The developed application calculates the static and dynamic response of a beam subjected to distributed and point force loads. The application can perform all the task if provided with appropriate command-line arguments.In the development of the application BLAS, LAPACK and SCALAPACK libraries were used whenever possible. In addition due to the symmetry and the sparse band of the matrices, symmetric banded storage was used to increase efficiency by decreasing storage size. Furthermore factorisation of the matrices was done before the start of the iterations. During the iterations only forward and back substitution was used to solve the systems of equations. Appropriate functions for populating the matrices and vectors as well as printing them were developed. Each of these functions were put in separate files for better code readability and manageability.

Task 1

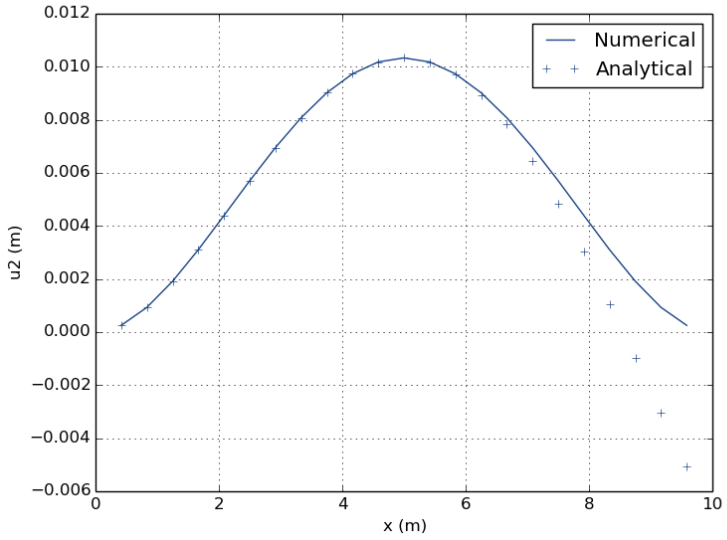
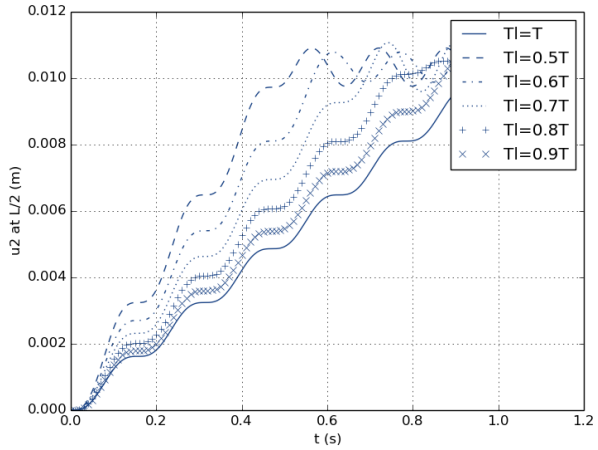
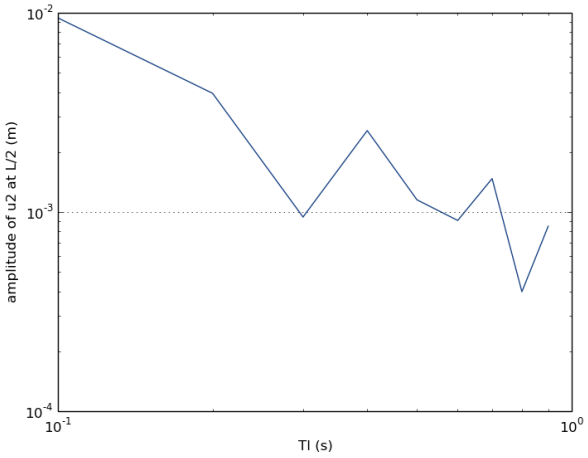


Figure 1. Comparison of numerical solution to analytical solution of static equation (analytical solution valid in the range 0<x<L/2)

Task 2



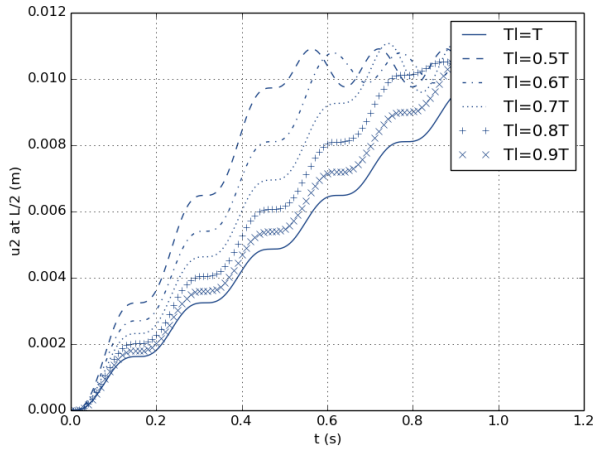
(a) y-displacement of middle node with respect to time



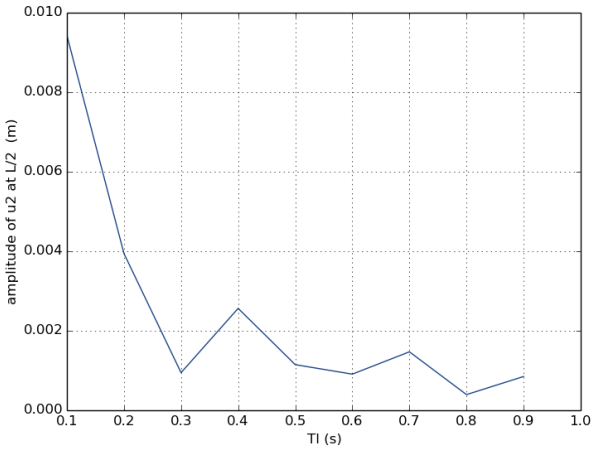
(b) y-displacement oscillation magnitude for different loading times

Figure 2. Explicit solution of dynamic equation

Task 3



(a) y-displacement of middle node with respect to time



(b) y-displacement oscillation magnitude for different loading times

Figure 3. Implicit solution to dynamic equation

Task 4

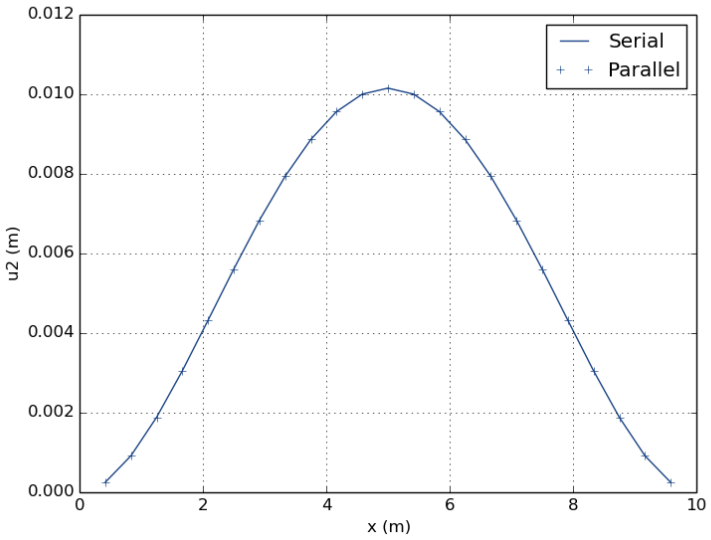


Figure 4. Serial and parallel explicit solution

Task 5

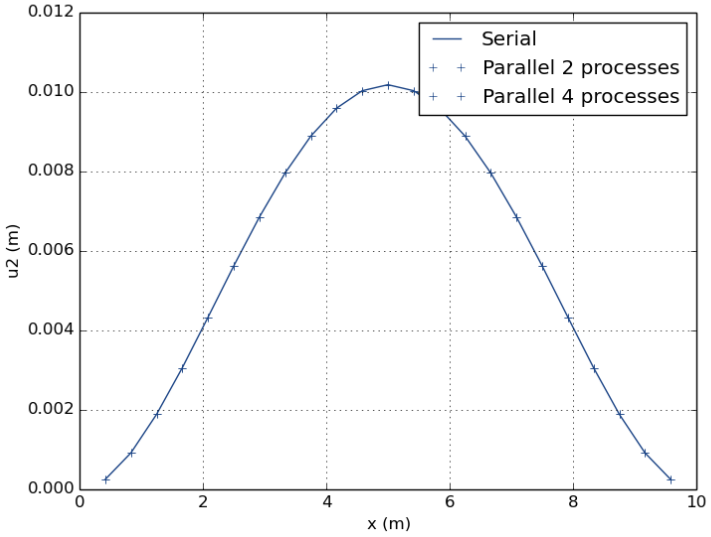


Figure 5. Serial and parallel implicit solution