Single element LS-DYNA analysis with MAT_CDPM (MAT_273)

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1 Introduction

This document describes the results obtained from a set of single element analyses with LS-DYNA Release 9.0.1 using MAT_CDPM (MAT_273). This material model is based on work published in Grassl and Jirásek (2006); Grassl et al. (2013, 2011). The aim of this study is to demonstrate the response obtained with MAT_CDPM in uniaxial tension and compression, and how it depends on the element length. More information on MAT_CDPM in LS-DYNA can be be found on:
http://petergrassl.com/Research/DamagePlasticity/CDPMLSDYNA/index.html

2 Cube subjected to tension

The first set of analyses consists of three cube elements of length 5, 10 and 20 mm subjected to uniaxial tension in the z-direction. The input files for these analyses are located in the folders CubeTensionSmall, CubeTensionMedium and CubeTensionLarge. The stress-displacement and stress-strain curves for the three analyses are shown in Figure 1 and Figure 2, respectively.

The displacement at which the stress becomes equal to zero is independent of the element length. Therefore, the model is expected to provide mesh-independent solutions in situations in which displacements localise in element length dependent zones, which is usually

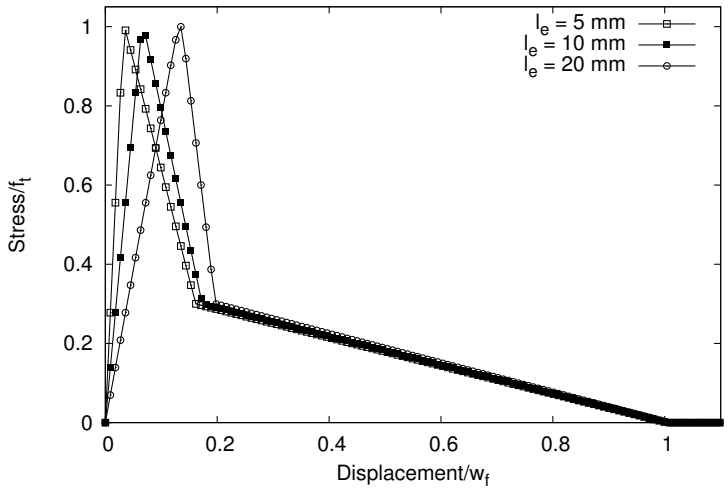

Figure 1: Stress versus displacement in uniaxial tension for cubes with three element lengths using MAT_CDPM.

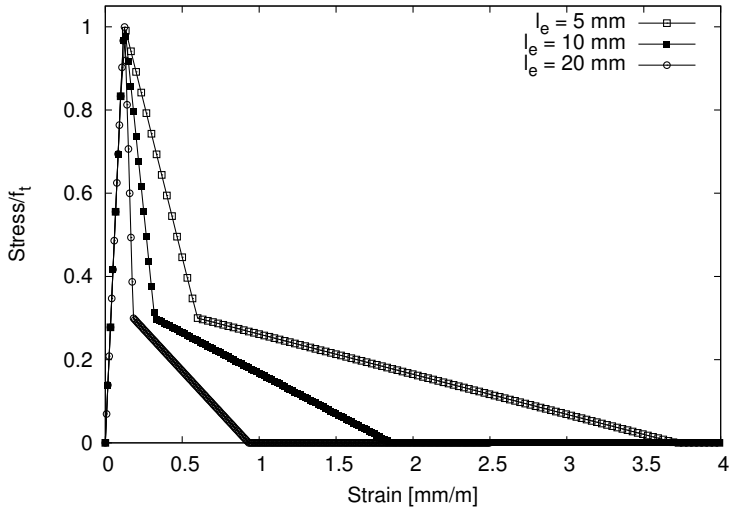

Figure 2: Stress versus strain in uniaxial tension for cubes with three element lengths using MAT_CDPM.

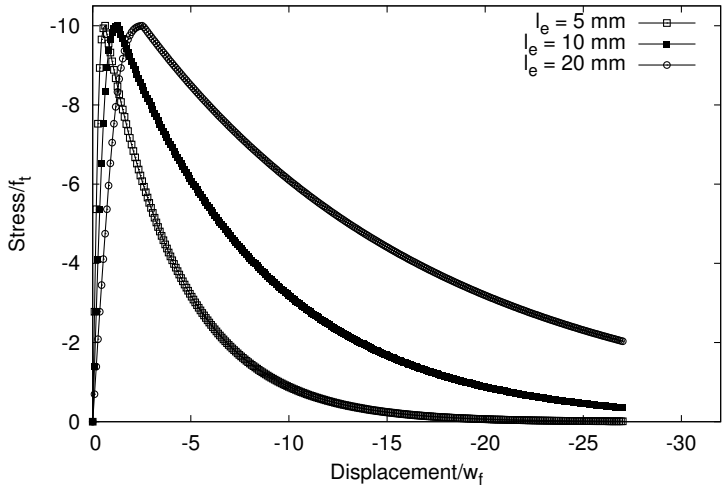

Figure 3: Stress versus displacement in uniaxial compression for cubes with three element lengths using MAT_CDPM.

expected for analyses involving cracking. Correspondingly, the stress-strain curves are mesh-dependent in the post-peak with the smallest element providing the largest strain at the point at which the stress becomes zero.

3 Cube subjected to compression

The second set of analyses uses the same cubes as in the first set. However, here the cubes are subjected to uniaxial compression in the z-direction. The input files for these analyses are located in the folders CubeCompressionSmall, CubeCompressionMedium and CubeCompressionLarge. The stress-displacement and stress-strain curves for the three analyses are shown in Figure 3 and Figure 4, respectively.

For compression, the stress-strain response is mesh-independent, where as the stress-displacement response is mesh-dependent. Therefore, the model is expected to provide mesh-independent results in analyses in which the displacements localised in mesh-independent regions, which is often the case for analyses involving compressive failure.

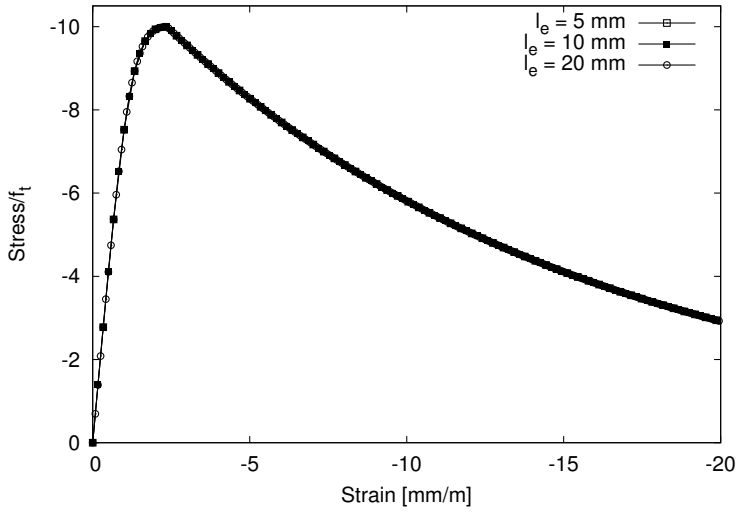

Figure 4: Stress versus strain in uniaxial compression for cubes with three element lengths using MAT_CDPM.

References

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