RamSeries - Validation Case 44

## Cook's problem

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1. Validation Case 44 - Cook problem

1.1. Model Description

This test case is based on the Cook's problem, a benchmark test proposed by Cook for nonrectangular quadrilateral elements and for which results have been published for many element types [1]. It consists on a clamped trapezoidal under end shear. The arrangement of the corresponding plane stress problem is depicted in the figure bellow:
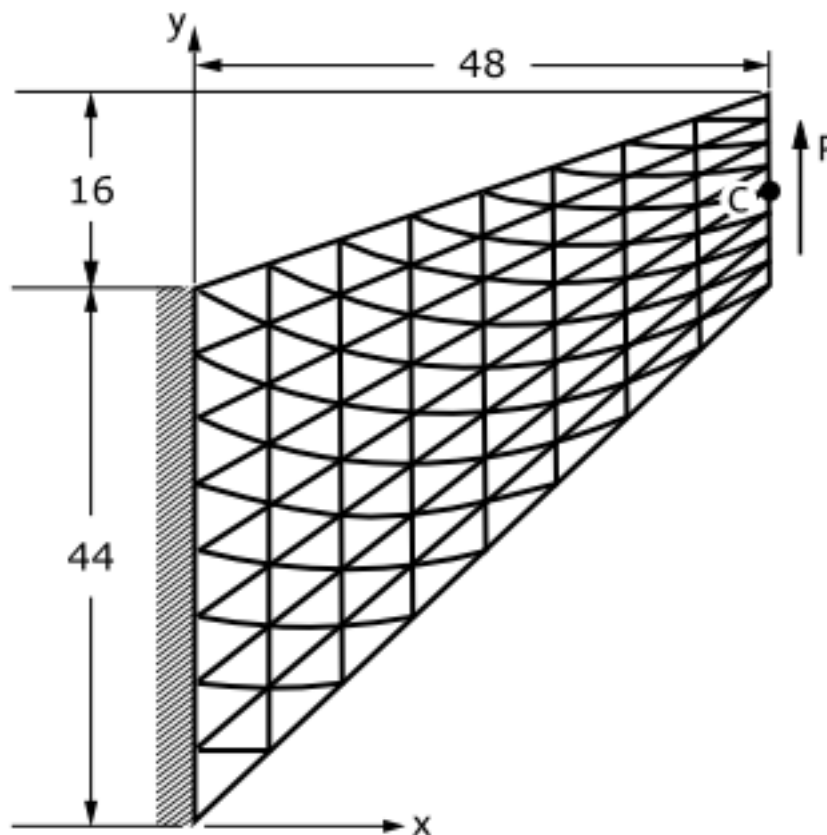
This is an academic problem for which the material is assumed to be linear elastic with the fictitious mechanical properties listed below:

Shell thickness: t = 1 m

Young's modulus: E = 1 Pa

Poisson coefficient: v = 0.3333

1.2. Results

It doesn't exist a known analytical solution, but the optimal results for the 64x64 mesh may be used for the sake of comparison. In this sense, extrapolation of the OPT results yields a theoretical value for the vertical displacement for the mid-point of the loaded face u_{yc} = 23.956 m. The results reported in [1] for different element types are summarized in the following table and are compared with the results obtained in RamSeries using the different element types available. Both, linear and quadratic elements are tested in RamSeries.

Convergence of the vertical displacement
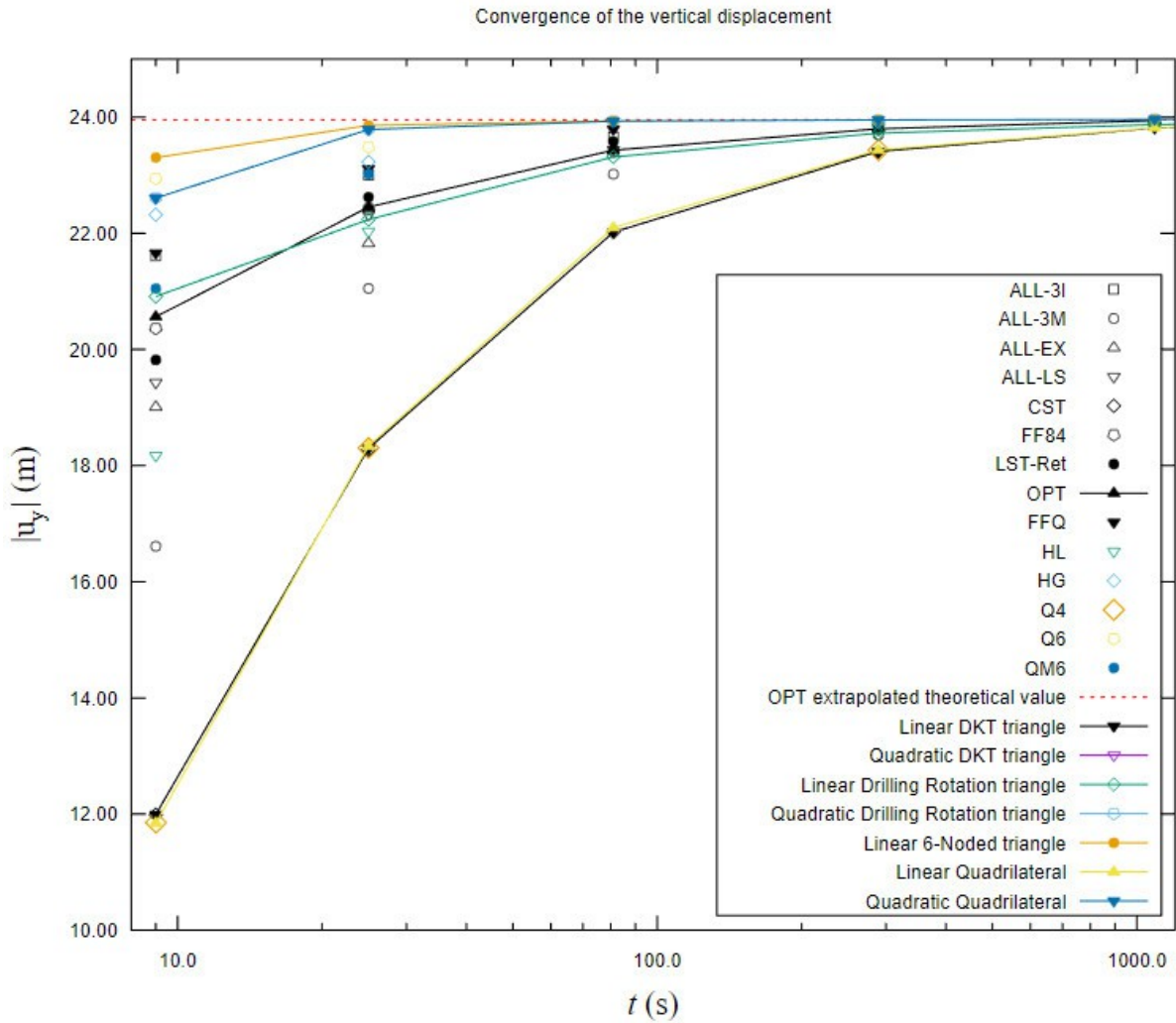
It can be observed that in this case the rate of convergence of the triangular elements is similar to that of quadrilaterals.

1.3. References

[1] C.A. Fellipa. A study of optimal membrane triangles with drilling freedoms. Report number CU-CAS-03-02, Center for aerospace structures. College of engineering university of Colorado (2002).

1.4. Validation Summary

CompassFEM version	15.1.0
Tdyn solver version	15.1.0
RamSeries solver version	15.1.0
Benchmark status	Successfull
Last validation date	27/11/2018