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# RamSeries - Validation Case 43

## Scordelis-Lo roof

RamSeries

**Version**
**15.1.0**

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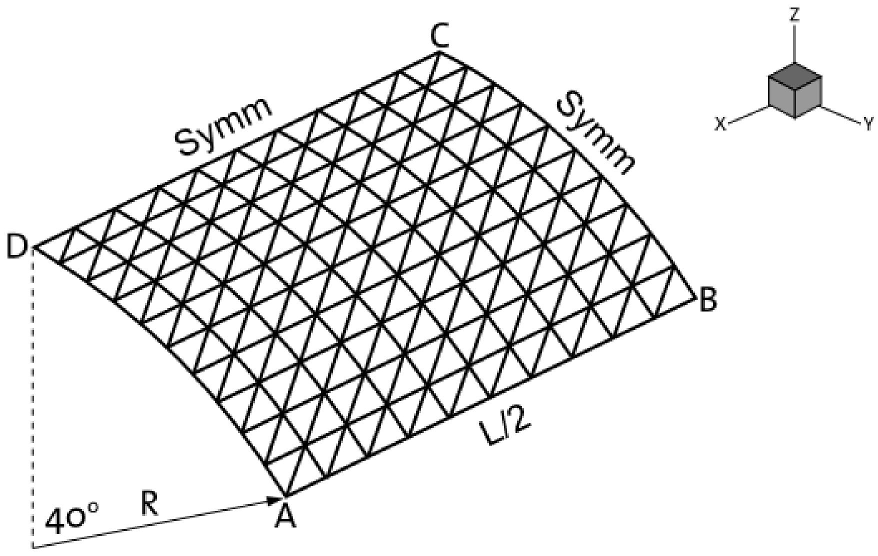
# 1 Validation Case 43 - Scordelis-Lo roof with self-weight

## Model Description

The geometry, material properties and the boundary conditions used in this test case are shown in the figure below. Only one quadrant of the roof is analyzed with just a self-weight load condition. For the sake of validation, the convergence of the vertical downward deflection at the mid-point of the free edge is evaluated. Results are compared against those reported in [1-5].




Schematic representation of the geometrical model used to analyze the Scordelis-Lo roof problem. Only one fourth of the roof is modelled using the appropiate symmetry boundary conditions

Roof radius: R = 25 m

Roof length: L = 50 m

Shell thickness: t = 0.25 m

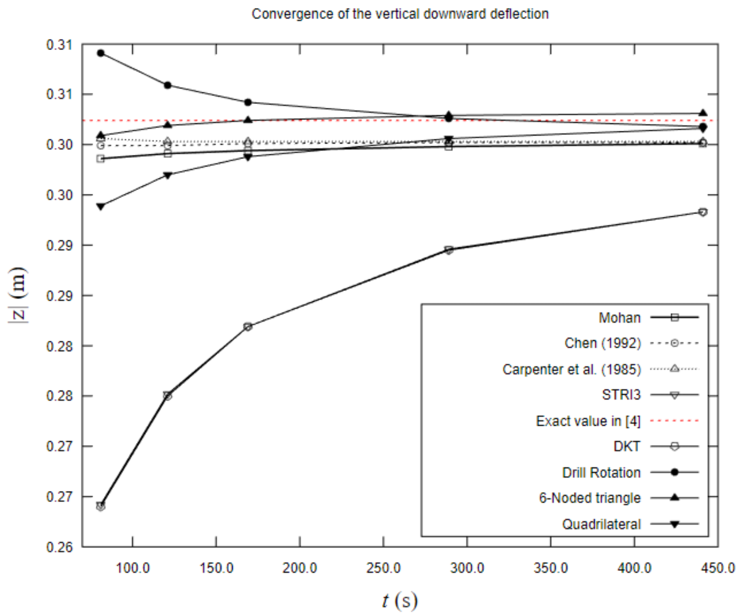
Young modulus: E = 4.32e8

Poisson coefficient: v = 0

Self weight: 90 N/m$^2$

## Results

In the following graph, RamSeries results are plotted together with several series of data compiled and reported in [1]. The exact value of the vertical downward deflection at the mid-point of the free edge is 0.3024, as stated in [4].




As it can be observed, the rate of convergence of the drilling-rotation element is similar to that of the quadrilateral, and both are much better than the rate of convergence of the classical DKT element. In addition, it should be noted that the converged value of the vertical deflection is closer to the exact value when using the drilling-rotation element.

## 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 |

## References

[1] P. Mohan. Development and applications of a flat triangular element for thin laminated shells. PhD Thesis. Blacksburg, Virgina (1997).

[2] D.J. Allman. Evaluation of the constant strain triangle with drilling rotations. International Journal for Numerical Methods in Engineering, Vol. 26, pp. 2645-3655 (1988).

[3] D.J. Allman. A compatible triangular element including vertex rotations for plane elasticity analysis. Computers and structures, Vol. 19, pp. 1-8 (1984).

[4] N. Carpenter, H. Stolarski and T. Belytschko. A flat triangular shell element with improved membrane interpolation. Communications in Applied Numerical Methods, Vol. 1, pp. 161-168, (1985).

[5] H.C. Chen. Evaluation of Allman triangular membrane element used in general shell analysis. Computers and Structures, Vol. 43, pp. 881-887 (1992).