

RamSeries - Validation Case 26

Cable Network



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1 Validation Case 26 - Cable Network

Model Description

This test case is based on the example "Plane cable net" described in Ref. [1].

A plane cable net subjected to both static and dynamic loadings. The following image shows the geometry:



The lumped mass at each node is assumed to be $8.76 \text{ Ns}^2/\text{mm}$. The static load is applied first to the structure by an static analysis, and then an earthquake loading is applied in the vertical direction of the structure by a nonlinear time-history analysis.

The load time history is given by the acceleration data registered during El Centro earthquake (Ref. [2]).











The properties of the plane cable net, are the following (the material is assumed to be linear elastic):

Cross-sectional area:A = 146.45 mm² Elastic modulus:E = 82.737 MPa Yield stress: σ_y = 420 MPa Cable self-weight: ρ = 1.459 N/m Pre-stressed force of horizontal members: PSF_h = 24.283 kN Pre-stressed force of inclined members: PSF_i = 23.687 kN Vertical load at all internal nodes: P = 35.586 kN

Results

For the sake of validation, a simulation was run using the properties described in the previous section, using a linear beam mesh (84 elements, 84 nodes).

The total time of the simulation is T= 74 s, with a time step of $\Delta t = 0.02$ s. An initial 20 second period has been run, in order to make the structure reach equilibrium with the static loads (puntual loads and self-weight); then the earthquake acceleration is applied.

Displacements results:

The next image shows the dynamic response at a central node of the plane cable net, under the El Centro earthquake acceleration load.



Vertical displacement (m)



References

[1] H.T. Thai, S.E. Kim. Nonlinear static and dynamic analysis of cable structures. Finite Elements in Analysis and Design, 2011, vol. 47, pag. 237-246.

[2] http://www.vibrationdata.com/elcentro.htm



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