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Geometrically Nonlinear Analysis of Three Dimensional Structure Model by Finite Element Technique with Coordinates Assumption

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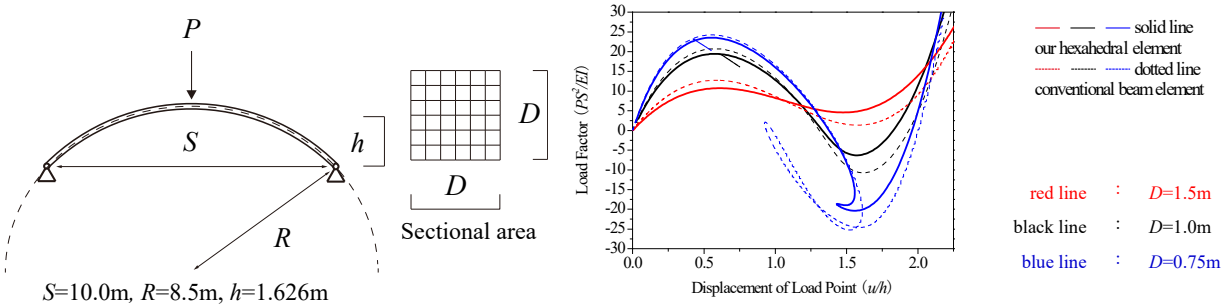
Abstract

This paper describes effectiveness and significance of the geometrically nonlinear analysis using the finite element technique that adopt our expanded three-dimensional (3D) element. The geometrically nonlinear analysis of a 3D structure model came to be executed comparatively easily by recent advancement of the computer performance. However, the development of an efficient finite element is needed as 3D element. In this paper, we present the formulation of 3D element with coordinates assumption for the geometrically nonlinear analysis. An unknown variable of this element is a coordinate value of global coordinate system after the deformation on the structure model. Therefore, when the whole stiffness matrix of the structure model is built, this element doesn't need coordinate transformation at all. The finite element technique with coordinates assumption is developed for the tension structure analysis, and the effectiveness is confirmed [1,2]. Analysis model is a circular arch model. Numerical results are compared by using 3D element with the coordinates assumption and the conventional beam element with displacement assumption. Finally, we denote an example of bucking load maximization using the sensitivity analysis as the structural optimization [3].

The figures below are an analysis model and a numerical example for the circular arch of uniform section with concentrated load. It is shown that the numerical result of both elements is corresponding according to decrease of the sectional area.



Analysis model Numerical results

Figure A numerical example for the circular arch of uniform section with concentrated load

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