Study on higher order of basis functions for S-version Isogeometric Analysis Method

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In Finite Element Method (FEM), it is estimated that the design of the analytical model accounts for about 80 % of the total analysis. In recent years, Meshfree method have been studied in order to shorten the generation of analytical models. One of them is Isogeometric Analysis (IGA), which uses Non-Uniform Rational B-Spline (NURBS), a geometric representation of CAD, as basis functions. In addition, the S-version Finite Element Method (S-FEM), which is a multi-scale analysis that enables flexible modeling and high accuracy of FEM analysis, has been proposed to be applied to IGA analysis, S-version Isogeometric Analysis Method (S-IGA). In this study, examples of IGA analysis and S-IGA analysis with higher order of basis functions are presented to verify the accuracy of the analysis. In the IGA analysis, as shown in Figure 1, the third-order basis functions were more accurate than the second-order basis functions for the same degrees of freedom. In the S-IGA analysis, the highest accuracy was obtained when the order of basis functions was set to the third-order for both the Global and Local patches. As shown in Figure 2 and Figure 3, the distribution of results was smoother when the third-order basis functions were used. It was also confirmed that setting the ratio of the overall size of the Local patch to the element size of the Global patch between 2.5 and 4 times prevented the phenomenon of reduced analysis accuracy.
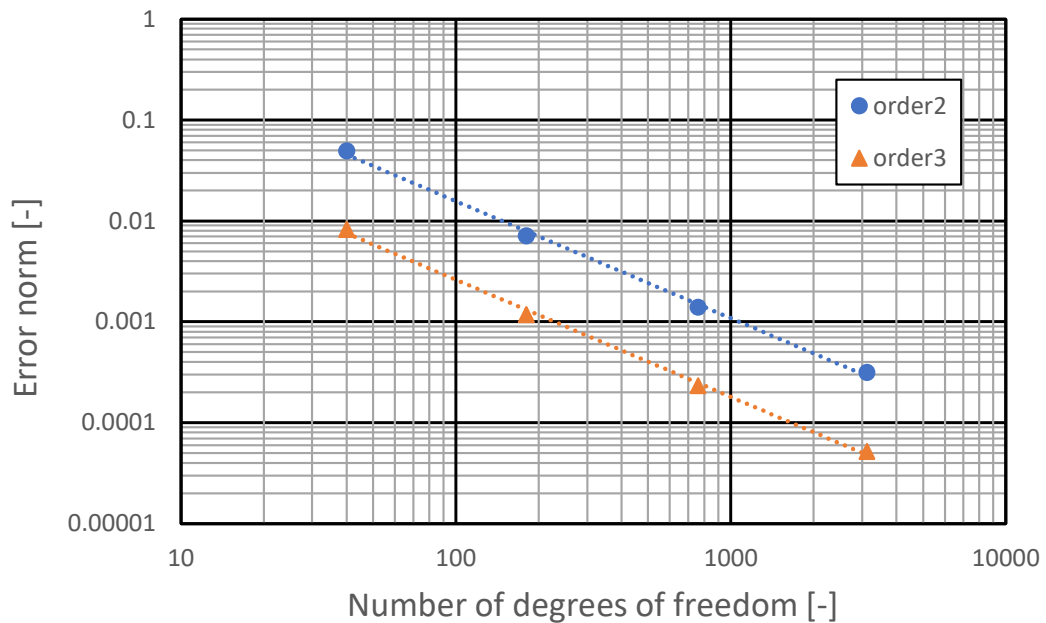

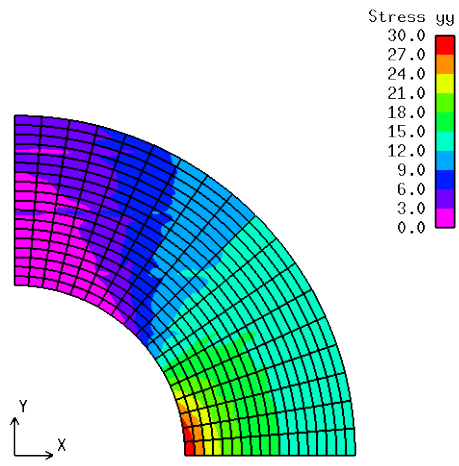Fig. 1   Error norm of σ_{rr} in the IGA analysis

Fig. 2　Stress in *y* direction on Local patch in the S-IGA analysis (second-order, Global patch 30 × 30, Local patch 20 × 20)

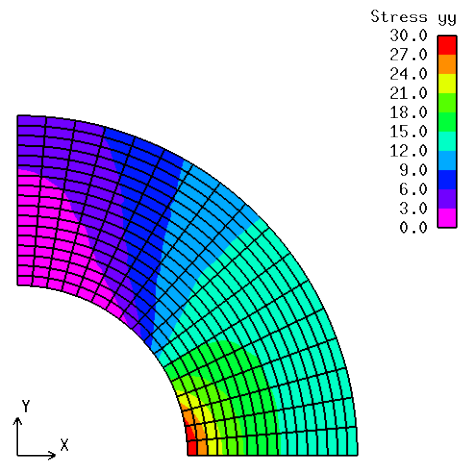Fig. 3　Stress in *y* direction on Local patch in the S-IGA analysis (third-order, Global patch 30 × 30, Local patch 20 × 20)