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Studies on the ultimate strength of several structures

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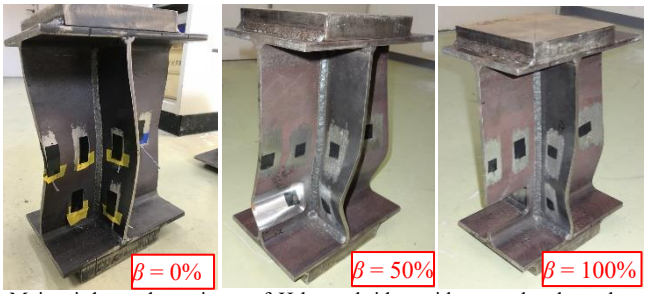
Keywords	structures, ultimate strength, finite element method, artificial intelligence
Technical Support Skills	Ultimate strength evaluation of several structures based on non-linear finite element method Finite element method program development for estimating ultimate strength evaluation Ultimate strength evaluation of steel structures based on model testing Application of artificial intelligence to the ultimate strength evaluation on several structures

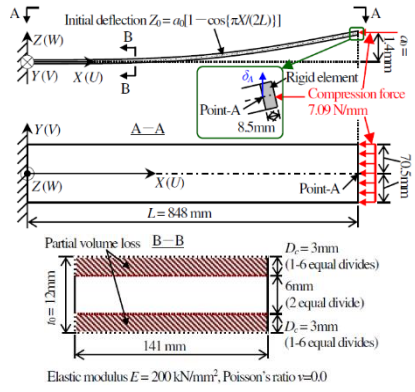
Research Contents

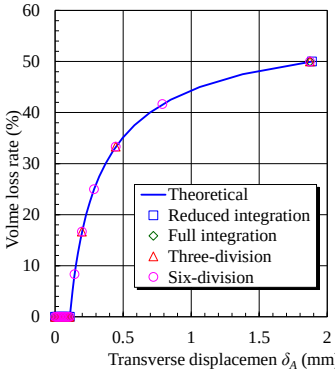
(1) Redundancy evaluation of the steel bridge due to its member failure and volume loss by using non-linear finite element method
(2) Exploitation of finite element simulation method which is able to model partial volume loss of steel plate with the element elimination
(3) Strength test using model specimen with volume loss of the steel structure
(4) Mechanical properties estimation of structural stainless steel required for constructing constitutive equation using machine learning

Verification analysis of steel truss bridge redundancy due to break of lower chord member
(Axial force is transmitted from broken lower chord member to the opposite side of the chord.)

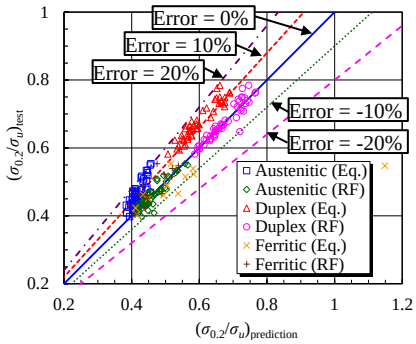


Main girder end specimen of H-beam bridge with several volume loss rates β after compression test
(In case of specimens with β = 50, 100%, significant out-of-plane displacement tends to occur near the cross-section including volume loss portion, because compressive stress increase in the portion.)





Cantilever steel plate progressing partial volume loss on its front and rear surfaces under compression
(20 nodes solid elements are applied to partial volume loss area on front and surfaces of the plate by dividing 1-6 layers. Partial volume loss is introduced by eliminating the elements. In case of 1 divide model, reduced integration is carried out as well. Numerical results between volume loss rate and transverse displacement at the tip of the plate are good agreement with the result by beam theory regardless of element divisions.)



0.2% proof stress estimation of austenitic, duplex and ferritic stainless steels by using Random Forest as one of machine learning method and their prediction equations
(Predicted value by Random Forest shows high accuracy in comparison with that by prediction equation)

Available Facilities and Equipment

Universal hydraulic testing machine (2000kN capacity)	General purpose finite element analysis program MSC Marc/Mentat
Personal computer (Dell Precision 3640)	Self-made non-linear finite element analysis program
Personal computer (Be-Clia)	Exterior digital caliper gauge (TECLOCK GMD-1J)
Intel Fortran compiler	Digital point micrometer (Niigata Seiki MCD232-25P)
General purpose pre and post processor GiD	Portable Data Logger (TML TDS-150)