6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

COUPLING MATRIX FOR BOUNDARY CELLS OF A CARTESIAN GRID METHOD USING A TRANSFER-MATRIX METHOD

Junya Imamura[1]

[1] Wako-shi, Honcho 31-9-803, Saitama/Japan, 351-0114, jimamura@ra2.so-net.ne-jp

Key Words: *Coupling matrix, Transfer matrix method, Reduction method, Boundary cell, Cartesian grid method, C^1-continuity element, Immersed boundary method.*

The objective of the immersed boundary method spotlighted in recent years is to immerse a coupling matrix into the boundary cells of a Cartesian grid method.
The transfer-matrix method (also referred to as the reduction method) automatically includes a coupling matrix by providing a rigid element and can easily partially include very large stiffness elements.

The transfer-matrix method can be elegantly applied to one-dimensional problems; However it is difficult to find a reliable method for two- and three-dimensional problems. [1]
In a previous report [2], a novel reduction method for continuum mechanics was proposed. In another report, a generalised force method was proposed [3].

Both methods simultaneously solve equations constructed using both equilibrium equations and compatibility equations.
The primary technique is to use an absolute maximum pivot element to eliminate a parameter for the Gaussian method using a sweep-out that includes swapping the columns.

These methods use a stiffness matrix to construct the equilibrium equations, and the compatibility equation rows set only the displacement equations $d_A=d_B= \cdots =d_N$ on the node where the N-vertex nodes of the finite elements are joined.

These methods are intrinsic displacement methods, therefore, the elements require C^0-continuity and are sufficient.
In this report, C^1-continuity elements are used to construct the coupling matrix for plate bending to transfer the displacements $\{w, \boldsymbol{\theta}\}$and the forces $\{\boldsymbol{M}, \boldsymbol{Q}\}$.

REFERENCES

[1] E. Knopf, Elektronische Berechnung von Stabtragwerken, *Konstruktiver Ingenieurbau-Berichte Heft 3,* Institut fuer Konstruktiven Ingenieurbau der Ruhr-Universitaet Bochum, Vol.**3**, Vulkan-Verlag, 1969.
[2] J. Imamura and T. Tanahashi, An application of the reduction method to continuum mechanics, *Proceedings of applied mechanics*, JSCE, Vol.**2**, pp.241-252, 1999.
[3] J. Imamura, Generalized force method (GFM) and a numerical solution of the simultaneous equation, *Proceedings of applied mechanics,* JSCE, Vol.**19**, J-STAGE, 2016.