Three-point bending crack propagation analysis of beam subjected to eccentric impact loading by X-FEM

- Toru Tsuda
  ITOCHU Techno-Solutions Corporation, Umeda, Kita-ku, Osaka, Japan
- Yoshihiro Ohnishi
  ITOCHU Techno-Solutions Corporation, Kasumigaseki, Chiyoda-ku, Tokyo, Japan
- Ryo Ohtagaki
  ITOCHU Techno-Solutions Corporation, Umeda, Kita-ku, Osaka, Japan
- Kyuchun Cho
  Faculty, Graduate School of Maritime Sciences, Kobe University, FukaeMinami-machi, Higashinada-ku, Kobe, Japan
- Takehiro Fujimoto
  Faculty, Graduate School of Maritime Sciences, Kobe University, FukaeMinami-machi, Higashinada-ku, Kobe, Japan

KEYWORDS:
Impact analysis, Crack propagation, Cohesive model, Three-point bending, X-FEM, EFG, Eroding

ABSTRACT:

When analyzing of a failure or crack propagation problem using FEM, there are the following challenges to solve. (1)It's necessary to make element boundary match to the failure surface or the crack surface. (2)The failure shape and the crack propagation direction depend on the mesh. (3)It's necessary to express a singularity of crack tip field. (4)Predictive criteria of the crack propagation path and speed are required. To overcome these challenges, Nishioka, et al. developed the moving finite element method which repeats mesh subdivision with crack propagation and succeeds to analyze a dynamic crack propagation problem with a high precision [1].

On the other hand, erosion technique generally used to describe the failure in fracture analysis by general-purpose FEM cord including LS-DYNA. However, it is difficult to evaluate it exactly from a point of view as shown above.

In contrast, the extended finite element method X-FEM is expected as technique to overcome the above problem to be able to express crack progress by adding a function to express a discontinuity and singularity of the crack to the shape function of the finite element instead of expressing the crack explicitly.

Therefore, in this study, we applied FEM with eroding, EFG, X-FEM for three points bending of crack propagation problems of the beam subjected to eccentric impact loading show in figure 1 and evaluated problems and the effectiveness of each technique through the comparison with the experiment result.

[1] T.Nishioka, et al, Int, J. Solids Struct., 38, 30-31, 5273, 2001.

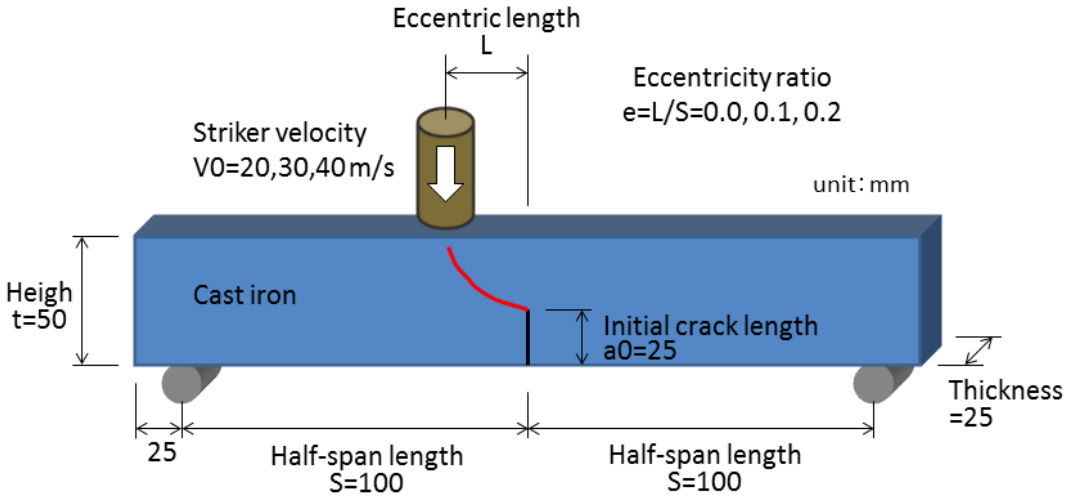

Fig.1 Impact specimen