



# Guest Editorial

## Special Issue: Recent Advances in Design and Structural Integrity of Pressure Vessels, Piping and Components

The design and structural integrity evaluation of pressure retaining equipment are crucial elements in the nuclear, oil, and gas industries. Accordingly, many research has been done to improve the accuracy of design and structural integrity assessment methodologies and to develop new techniques and procedures. In this special issue, it is intended to introduce the latest research results on these subjects. The papers in this issue were collected from two groups.

The first group is peer-reviewed technical papers selected from those presented at the 16th APCFS 2020 (Asia-Pacific Conference on Fracture and Strength 2020, Jeju Island, November 2020) conference. The conference was organized by the Division of Materials and Fracture, The Korean Society of Mechanical Engineers (KSME). Historically, the first conference was held in 1984 (Sendai, Japan) and the subsequent conferences have been held alternately every two years in Korea, Japan, China, and Australia. A total of 229 papers were presented in the APCFS 2020, in spite of the COVID-19 situation. Among these, eight papers were selected for this special issue, covering

- New flaw shape idealization rules to improve the accuracy of deterministic/probabilistic fracture mechanics analyses (complex and transition cracks)
- Structural integrity evaluation technology for nuclear and gas pipelines based on damage mechanics
- Evaluation of creep-fatigue damage in high-temperature equipment
- Latest research and program development results for probabilistic integrity evaluation

The second group is papers invited from research institutes and universities around the world by Guest Editors. Seven papers on fatigue, ductile damage, and fracture assessment were invited from Japan to introduce Japanese research activities in the nuclear industry. In addition, three papers on international round robin (RR) activities were also invited: one on ductile fracture simulation, organized by CRIEPI (Japan), and the other on constraint effect on fracture initiation toughness for surface-cracked pipe/fittings, organized by Engineering Mechanics Corporation of Columbus (US). The objective of the former RR is to identify the applicability and pros and cons of each damage mechanics models by comparing the ductile crack growth behavior predicted by various damage mechanics models. A total of eight organizations in Japan, Korea, and France participated in the RR. The objective of the latter RR is to quantify the crack-tip constraint effects of small-sized specimens with various geometries on the prediction of crack initiation of large-scale gas pipeline. In this constraint RR, various constraint-related fracture mechanics parameters and techniques including damage mechanics have been employed to propose the most efficient way of constraint-corrected fracture mechanics assessment.

We hope that this collection of technical papers will be of high interest to those interested in the design and structural integrity of pressure retaining equipment of energy industries. Finally, we would like to express sincere thanks to Prof. Young W. Kwon, Editor-in-Chief of ASME *Journal of Pressure Vessel Technology*, and publishing officers for their kind assistance in the publication of this special issue.



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