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REPLY

Reply to the "Discussion on "Data-driven Methods to Predict the Burst Strength of Corroded Line Pipelines Subjected to Internal Pressure" by Jie Cai et al. https://doi.org/10.1007/s11804-022-00263-0"

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With the booming of Industrial Internet of Things (IIoT) and Artificial Intelligence (AI), the objective of the work in Cai et al. (2022) is to explore the utilizing of data-driven methodology for the prediction of the burst strength of corroded pipelines, which can hopefully overcome the common drawbacks of widely-used traditional Finite Element Method (FEM) and the needs of sufficient domain knowledge. The authors in Cai et al. (2022) are **not aiming to overthrow the functionality and beneficence introduced by physical-based methods and widely-used empirical/semi-emprical engineering expressions**, such as the DNV standars (DNVGL, 2017) in offshore engineering.

As stated in Section 7 of Cai et al. (2022), the work has provided an alternative research fashion on pipeline strength investigation. The conclusion point (4) indicates that there is still a space to improve for the existing empirical models with respect to accuracy and generalization ability. **In order to avoid the "misunderstanding" caused by this conclusion point, this conclusion statement will be removed from the published paper of Cai et al. (2022).** It should be noted that, the limitations of the data-driven methods have been explicitely stated in the work of Cai et al. (2022), as seen in the final paragraph of Section 6.5 and Section 7. The developed models imply a promising utilization of data-driven methods in pipeline engineering, especially with the rapid development of smart senosrs, Internet of Things (IoT), modern connectivity and cloud computing.

In the final paragraph of Section 6.5 in Cai et al. (2022), a discussion has been explicitely provided on the chosen of yield stress and UTS in Eq. (13) which could be replaced by the SMYS and SMTS, respectively. Discrepancies could be introduced and futher research is needed. Due to the un-transparancy of experimental pipe data from literature, especially for the value of σ_u, the engineering standard (API, 2004) is therefore used for the material property values, which will inevitably introduce discrepancies for calculations and simulations.

In Section 3 of Cai et al. (2022), a detailed description has been provided for the selection and simplicaiton of pipe features for the purpose of data-driven approach. Only a pipe with a single external corrosion defect is considered and the defect parameters, including width, length, depth and defect angle along the pipe axis, need to be properly defined and simplified. Therefore, three types of defect angles are proposed, which is 0° (Longitudinal defect), 90° (circumferencial defect) and angled defect (simplified as other angles), as seen in Figure 6 of Cai et al. (2022). **The authors of the discussion claimed that the pipe defect parameters are incorrectly selected for the S.N. 33, which is not correct.** The S.N. 33 in Cai et al. (2022) is corresponding to the Test No. 3 pipe in Table 2 of Mok et al. (1991), where the Spiral angle is 0°, Depth ratio is d/t=0.47, Width ratio is W/t=0.47, and Length is not available. **Note that the angle definition from Mok et al. (1991) is different with the one from Cai et al. (2022).** In Section 2.1.1 of Mok et al. (1991), it is defined that the circumferential defect is with an angle of 0° and the longitudinal defect angle is 90°, as seen in Section 2.1.2 and Figures 1 and 2 of Mok et al. (1991). However, for the angle definition of Cai et al. (2022), it is the other way around, as seen in Fgiure 6. Regarding to the wall thinness of this pipe (t = 6.35 mm) and the opposite definitions of defect angles, **the corresponding parameters of S. N. 33 for depth and width in Cai et al. (2022) are therefore 2.984 5 mm and 102.235 mm, respectively.** Due to the missing value for the length of the circumferential defect in Test No. 3 pipe from the Table 2 of Mok et al. (1991), it is therefore simplified as 10 mm along the pipe axial direction, which introduces discrepancies.

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Regarding to the use of DNV rules for comparison, it is confused to know why the authors of this discussion argued about the selections. Like choosing machine learning algorithms, people normally choose typical ones for research and comparison purpose instead of choosing every single method inside a single piece of research work. Further work will be done in order to compare among other mentioned standards.

The authors of the discussion claimed that their automated FEA tools are more powerful and the ML methods are not meaningful compared with theirs tools. **Although this is a statement out of the scope of the current work of Cai et al. (2022), it is very arguable and needs to be further demonstrated by research and industry practice, especially in the era of AI and digital twin.** Such a statement is abrupt and a bit subjective. The use of Cloud Computing, Smart Sensors, Machine Learning (ML) and Deep learning (DL) together with physical-based models has a great potential to be a game-changer in strength prediction of pipeline industry.

Note that the research work from Cai et al. (2022) does not deal with time-series dataset. Taking about the data collection from FEA, it is parametric and efficient, but it still needs to be validated by real experiments. That's why the authors from Cai et al. (2022) only used experiental data. The use of FEA may be a good supplement solution due to the lack of data, but it is out of the current research scope of the work from Cai et al. (2022).

Competing interest The authors have no competing interests to declare that are relevant to the content of this article.

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