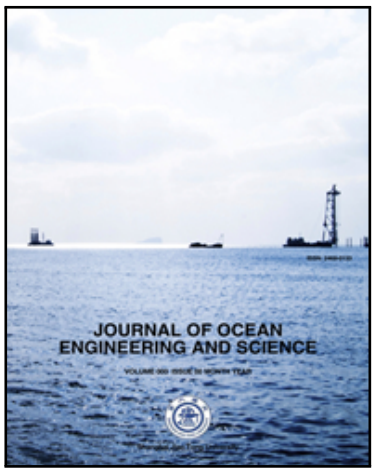

Fuzzy fault tree analysis of oil and gas leakage in subsea production systems

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Highlights

- This paper presents a probabilistic failure analysis of leakage of the oil and gas in a subsea production system using fuzzy fault tree analysis (FFTA). The system consists of four major areas where the leakages can be initiated, namely, gas and oil wells, pipelines, key facilities and third party damage.
- A fuzzy approach to event data employs expert elicitation and fuzzy set theories to calculate the failure probabilities of the intermediate events and the top event through identification of the minimal cut sets of the fault tree.
- A number of importance measures for minimal cut sets and the basic events have been obtained which helps to identify the nature of dependence of the top event on the basic events and thereby can identify the weakest links that may cause leakage in the subsea production system.
- Two aspects, namely, (a) the fuzzy weighted index of the basic events and (b) uncertainty of basic event probability using linear left and right spread approach; have been used in the analysis, which are less common in fuzzy FTA literature.
- It has been shown that the effect of uncertainty of basic events on the top event by fuzzy FTA is opposite to that by conventional FTA.
- It is found that the '*probability of the leakage*' (top event) is affected principally by the events '*third party damage*', '*failure of leakage control in pipe*', '*failure of connector leakage control*', '*rupture in riser*', '*overpressure in well*' and '*failure of control in well*', in that order.