

# **An application of the Option design pattern to the probabilistic fracture mechanics program**

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## **Abstract**

Software development or modification of software is one of significant issues for computational mechanics, because there are newly developed theories and techniques to be implemented. But the computational mechanics researchers are not always good programmers. Therefore there must be some or a large delay for their theories or techniques to be available for users. Even while researchers are developing their new theories or techniques, they may experience some difficulties to modify their software to calculate new cases which cannot be treated with the existing software.

The author has proposed the Option design pattern to solve this problem. The Option design pattern treat the functions of software as options, and its characteristics are; I) no modification is required to the existing program, II) independently developed options can be combined freely, III) each function can be implemented in one place, instead of scattering modifications into the existing program. First, it has been applied to finite element method programs to add functions, such as geometrical nonlinearity and dynamic analysis. In this paper, it will be applied to probabilistic fracture mechanics (PFM) programs which calculate failure probabilities for uncertain input data such as loading, strength and defect size.

Most of PFM programs are developed for specific purpose. When you want to analyze other problem, you should modify the program. There are many choices to define the loading and the strength. The structure of programs is much different from FEM programs. Moreover, there is no way to validate the software. While FEM programs can be validate by comparing the result with experimental results, no experiment can be done to get the failure probability in a specific situation. The next candidate for validation of PFM programs is a round robin analysis which several groups calculate the same problem with different software.

In this paper, differences in applying the Option design pattern to FEM program and PFM program will be discussed. Some RR problem will be calculated and the results will be compared with those of other research groups.

**Keywords: Probabilistic Fracture Mechanics, Design Pattern**