

Homework 6

FORM and MPP-Based MCS

1. The limit-state function of a shaft in a speed reducer is defined by the difference between the strength and the maximum equivalent stress. It is given by

$$g(\mathbf{X}) = S - \frac{16}{\pi d^3} \sqrt{4F^2 l^2 + 3T^2}$$

where

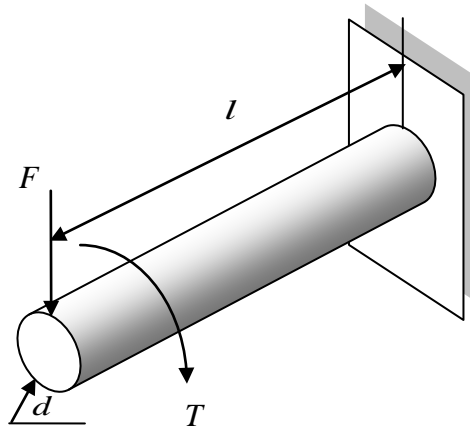
$d = 39$ mm, the diameter of the shaft

$l = 400$ mm, the length of the shaft

F = the external force

T = the external torque

S = the yield strength



The distributions of the independent random variables are given below.

Table 1 Distributions

Variables	Mean	Std	Distribution
External force F	2000 N	220 N	Normal
Torque T	450 N·m	50 N·m	Normal
Strength S	250 MPa	30 MPa	Normal

Use FORM to calculate the probability of failure. Please tabulate the MPP search process in the table shown below.

Iteration	\mathbf{U}	$g(\mathbf{U})$	α	β
1				
2				
3				

2. Use the MPP-based MCS to compute the probability of failure for the above problem. Attach your source code.