

The probabilities that the external force Q acts in locations M and N are 0.6 and 0.4, respectively, If Q acts at M , the probabilities of failure due to bending and shear are 0.001 and 0.0001, respectively. If Q acts at N , the probabilities of failure due to bending and shear failures are 0.002 and 0.0001, respectively. Determine (1) the probability of bending failures, (2) the probability of shear failures.



Solution

Define events as follows.

M – Q acts at M

N – Q acts at N

B – The beam fails due to bending

S – The beam fails due to shear

F – The beam fails

$$P(M) = 0.6$$

$$P(N) = 0.4$$

$$P(B|M) = 0.001$$

$$P(S|M) = 0.0001$$

$$P(B|N) = 0.002$$

$$P(S|N) = 0.0001$$

(1) From the total probability theorem, the probability of failure due to bending is

$$P(B) = P(B|M)P(M) + P(B|N)P(N) = 0.001(0.6) + 0.002(0.4) = 0.0014$$

(2) The probability of failure due to shear is

$$P(S) = P(S|M)P(M) + P(S|N)P(N) = 0.0001(0.6) + 0.0001(0.4) = 0.0001$$