

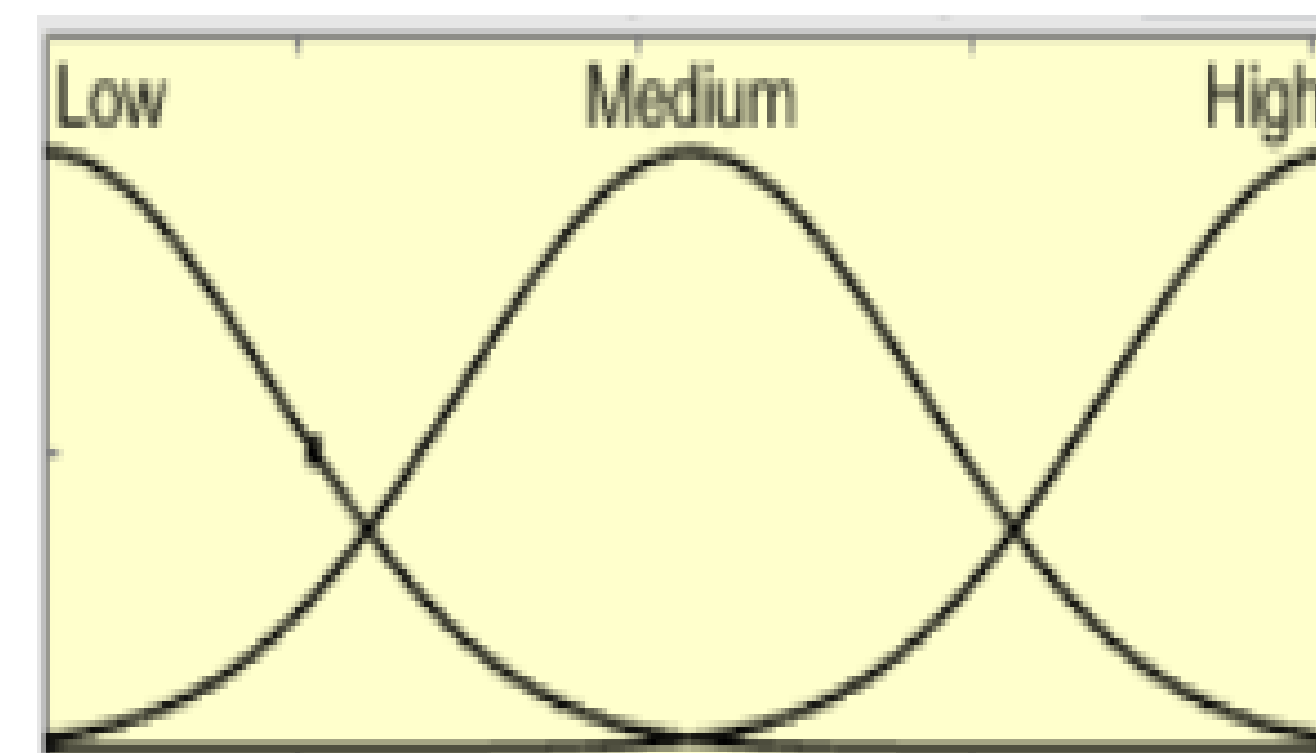
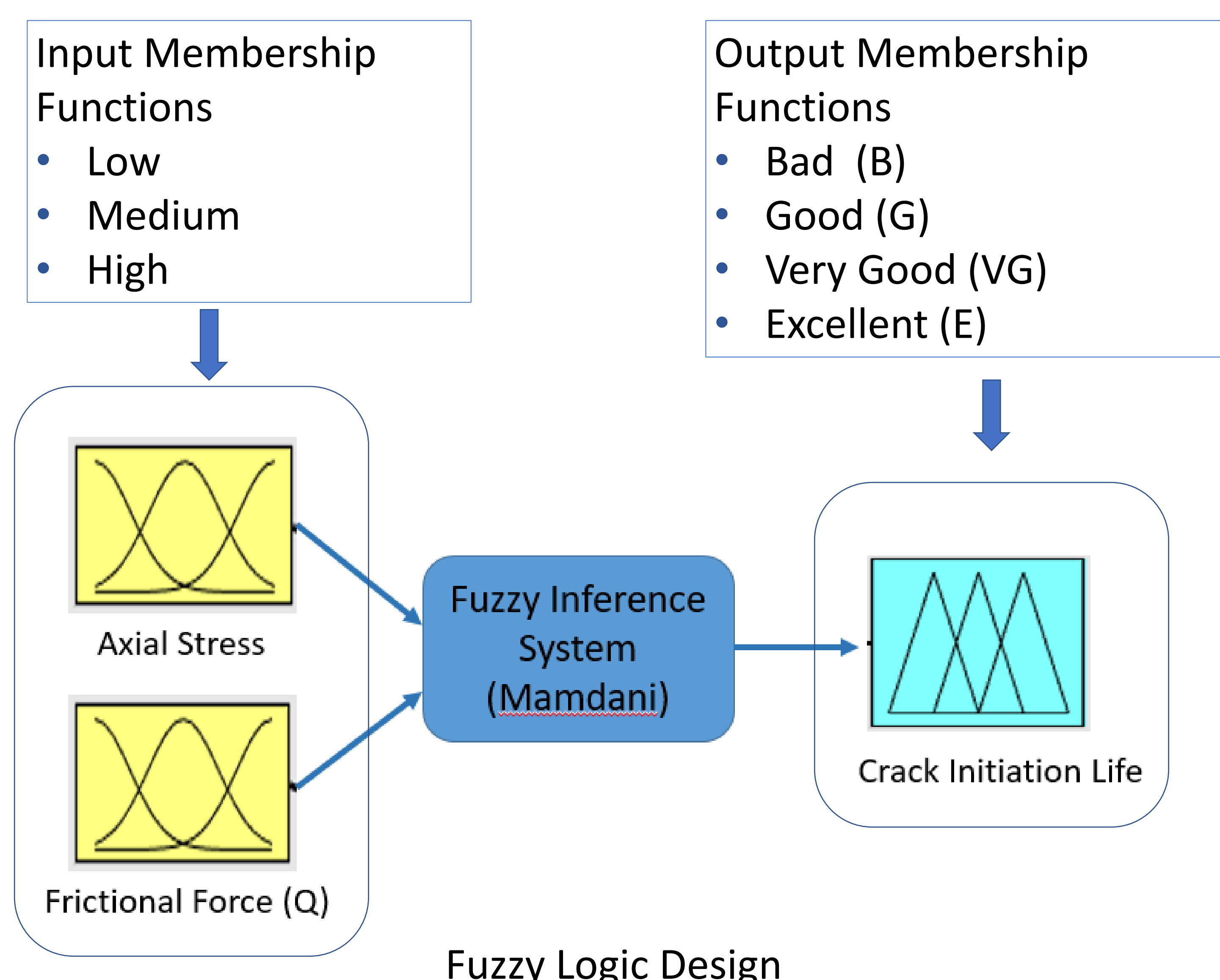
Introduction

Fretting fatigue is a significant issue in engineering, often causing premature failure of contacting components due to small oscillatory motion under cyclic loading. Traditional deterministic models struggle to predict fretting fatigue initiation accurately because of uncertainties in key input parameters. In this study, a fuzzy logic-based model is developed to predict the fretting fatigue crack initiation life of Ti-6Al-4V titanium alloy. The model is validated using the fretting fatigue experimental data available in the literature.

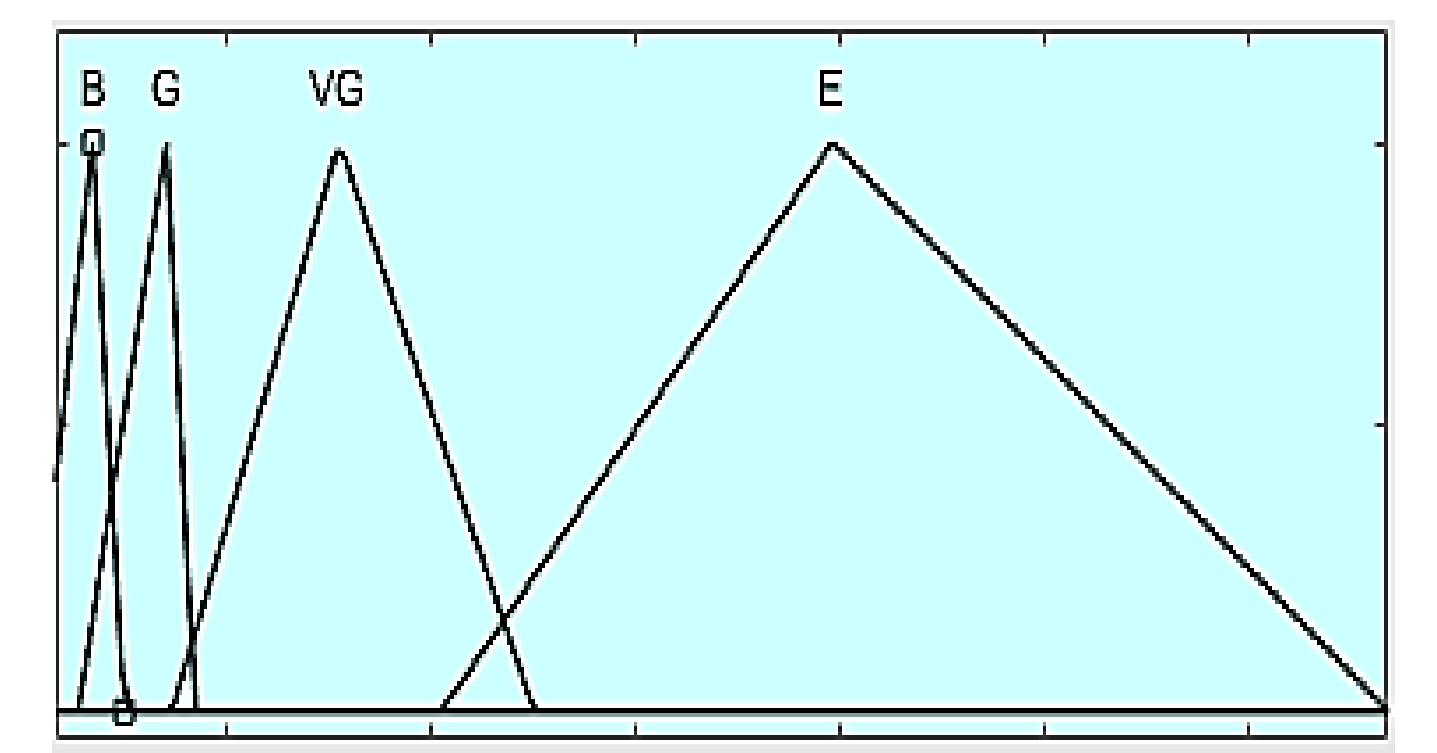
Methods

- The input parameters are Axial Stress and Tangential Stress and the output is crack initiation life
- Mamdani fuzzy inference (FIS) system is implemented using Matlab Simulink Fuzzy logic tool box
- Membership functions
Inputs: Gaussian
Output: Triangular
- Defuzzification method
Centroid of area (COA)

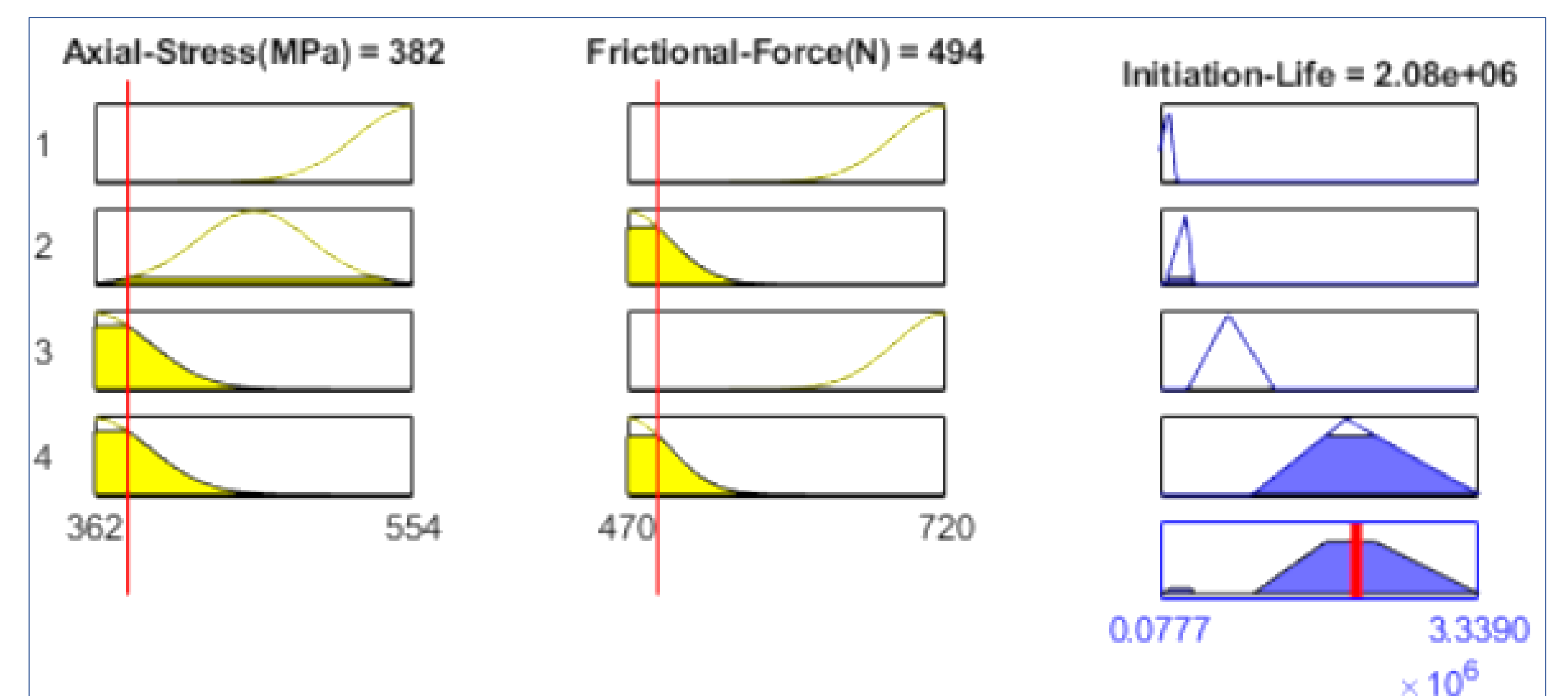
Graphics / Images



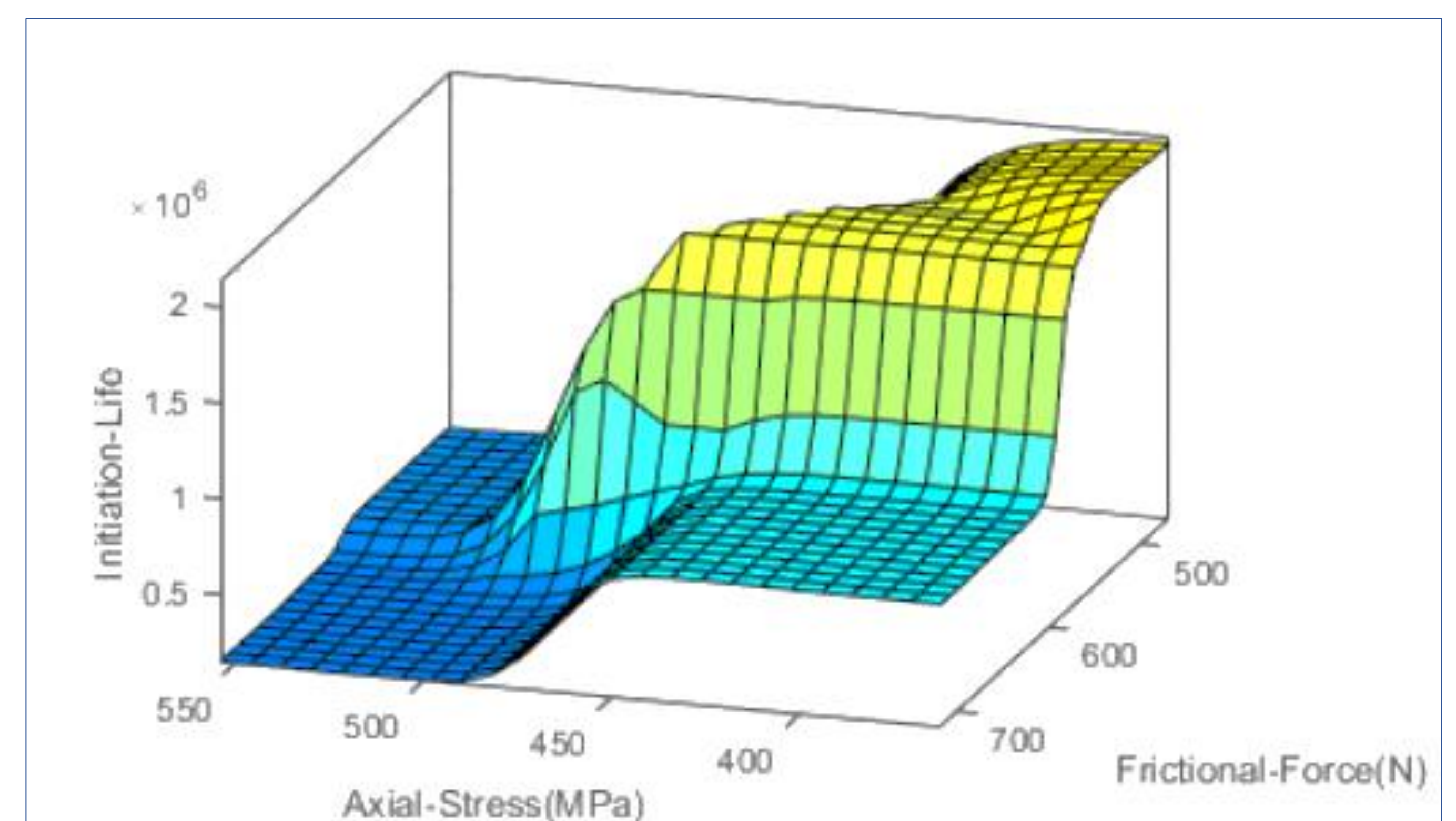
Gaussian input function



Triangular output function



Validation of fuzzy logic model



Parameter sensitivity analysis

Conclusions

- The model predicts the fretting fatigue crack initiation life using fuzzy inference system (FIS) based on two inputs.
- The accuracy of the fuzzy logic model depends on the number of input membership functions.
- Out of three tested data points, two lie within 2N and scatter band and one within 3N band.
- The sensitivity analysis of the input parameters show that the crack initiation life is more sensitive to axial stress variation as compared to frictional force.