|  |
| --- |
| CAE simulation 2 |

For the dog bone fatigue, find the safety factor and the number of repetitive loads before fatigue failure (Life) for the following four cases. For cases 1, 2, and 3, compare the analytical results with the Goodman theory. In this case, a new SS400 material is created and used for the analysis (E=200GPa, v=0.3, tensile strength 400MPa, yield strength 250MPa, endurance limit at laboratory condition Se=200MPa at 106 cycles) Apply the fatigue strength factor considering values at the service condition.

With the given condition, coefficients for considering stress concentration in the fillet structure can be calculated as follows :

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**Figure 1. Stress concentration table of fillet structure**

Since fatigue strength factor is set with 0.5, value at cycles has to be calculated with .

Following the Goodman theory, safety factor can be calculated with the following equation.

1. Fully reversed

- Apply cycles for infinite life

|  |  |
| --- | --- |
| **Life** | **Safety factor** |
|  |  |

Ansys simulation result about fully reversed fatigue factor indicates that with 2.3331e5 cycles, the safety factor in the part with ‘min’ marked is lower than 1 (). To get the theoretical value in this case, is set with , which is considered with stress concentration. Furthermore, value is set with at cycles , since the fatigue strength factor is

Safety factor in fully reversed case can be calculated as follows :

2. Zero-based

- Apply cycles for infinite life

|  |  |
| --- | --- |
| **Life** | **Safety factor** |
|  |  |

Ansys simulation result about zero based fatigue factor indicates that with 1e6 cycles, the safety factor in the part with ‘min’ marked is . To get the theoretical value in this case, is set with , which is considered with stress concentration. Furthermore, value is set with at cycles , since the fatigue strength factor is

Safety factor in zero-based fatigue case can be calculated as follows :

3. Ratio-based

- Apply cycles for infinite life

|  |  |
| --- | --- |
| **Life** | **Safety factor** |
|  |  |

Ansys simulation result about ratio based fatigue factor indicates that with 1e6 cycles, the safety factor in the part with ‘min’ marked is . To get the theoretical value in this case, is set with , which is considered with stress concentration. Furthermore, value is set with at cycles , since the fatigue strength factor is

Safety factor in fatigue with ratio-based case can be calculated as follows :

4. History data : Apply SAE Bracket History

- Apply blocks for infinite life

|  |  |
| --- | --- |
| **Life** | **Safety factor** |
|  |  |

Ansys simulation result about historical data-based fatigue factor indicates that safety factors of every part is about zero even though the cycle is not up to cycles.