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Soderberg and Goodman Lines Formulas

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List of 15 Soderberg and Goodman Lines Formulas

Soderberg and Goodman Lines

1) Goodman Line Amplitude Stress

$$fx \quad \sigma_a = S_e \cdot \left(1 - \frac{\sigma_m}{\sigma_{ut}} \right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 30\text{N/mm}^2 = 33.84615\text{N/mm}^2 \cdot \left(1 - \frac{50\text{N/mm}^2}{440\text{N/mm}^2} \right)$$

2) Goodman Line Endurance Limit

$$fx \quad S_e = \frac{\sigma_a}{1 - \frac{\sigma_m}{\sigma_{ut}}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad 33.84615\text{N/mm}^2 = \frac{30\text{N/mm}^2}{1 - \frac{50\text{N/mm}^2}{440\text{N/mm}^2}}$$

3) Goodman Line Mean Stress

$$fx \quad \sigma_m = \sigma_{ut} \cdot \left(1 - \frac{\sigma_a}{S_e} \right)$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad 49.99996\text{N/mm}^2 = 440\text{N/mm}^2 \cdot \left(1 - \frac{30\text{N/mm}^2}{33.84615\text{N/mm}^2} \right)$$



4) Goodman Line Ultimate Tensile Strength

$$fx \quad \sigma_{ut} = \frac{\sigma_m}{1 - \frac{\sigma_a}{S_e}}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 440.0004N/mm^2 = \frac{50N/mm^2}{1 - \frac{30N/mm^2}{33.84615N/mm^2}}$$

5) Limiting Value of Mean Stress

$$fx \quad S_m = f_s \cdot \sigma_m$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 100N/mm^2 = 2 \cdot 50N/mm^2$$

6) Limiting Value of Stress Amplitude

$$fx \quad S_a = f_s \cdot \sigma_a$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 60N/mm^2 = 2 \cdot 30N/mm^2$$

7) Permissible Mean Stress for Fluctuating Load

$$fx \quad \sigma_m = \frac{S_m}{f_s}$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 50N/mm^2 = \frac{100N/mm^2}{2}$$



8) Permissible Stress Amplitude for Fluctuating Load

$$fx \quad \sigma_a = \frac{S_a}{f_s}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 30\text{N/mm}^2 = \frac{60\text{N/mm}^2}{2}$$

9) Slope of Line OE in Modified Goodman Diagram given Bending Amplitude and Mean Bending Moment

$$fx \quad m = \frac{M_{ba}}{M_{bm}}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 0.6 = \frac{720\text{N*mm}}{1200\text{N*mm}}$$

10) Slope of Line OE in Modified Goodman Diagram given Force Amplitude and Mean Force

$$fx \quad m = \frac{P_a}{P_m}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 0.6 = \frac{45.6\text{N}}{76\text{N}}$$



11) Slope of Line OE in Modified Goodman Diagram given Stress Amplitude and Mean Stress

$$\text{fx } m = \frac{\sigma_a}{\sigma_m}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 0.6 = \frac{30\text{N/mm}^2}{50\text{N/mm}^2}$$

12) Soderberg Line Amplitude Stress

$$\text{fx } \sigma_a = S_e \cdot \left(1 - \frac{\sigma_m}{\sigma_{yt}} \right)$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 30\text{N/mm}^2 = 33.84615\text{N/mm}^2 \cdot \left(1 - \frac{50\text{N/mm}^2}{440.0004\text{N/mm}^2} \right)$$

13) Soderberg Line Endurance Limit

$$\text{fx } S_e = \frac{\sigma_a}{1 - \frac{\sigma_m}{\sigma_{yt}}}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)


$$\text{ex } 33.84615\text{N/mm}^2 = \frac{30\text{N/mm}^2}{1 - \frac{50\text{N/mm}^2}{440.0004\text{N/mm}^2}}$$



14) Soderberg Line Mean stress [Open Calculator](#) 

$$fx \quad \sigma_m = \sigma_{yt} \cdot \left(1 - \frac{\sigma_a}{S_e} \right)$$

$$ex \quad 50\text{N/mm}^2 = 440.0004\text{N/mm}^2 \cdot \left(1 - \frac{30\text{N/mm}^2}{33.84615\text{N/mm}^2} \right)$$

15) Soderberg Line Tensile Yield Strength [Open Calculator](#) 

$$fx \quad \sigma_{yt} = \frac{\sigma_m}{1 - \frac{\sigma_a}{S_e}}$$

$$ex \quad 440.0004\text{N/mm}^2 = \frac{50\text{N/mm}^2}{1 - \frac{30\text{N/mm}^2}{33.84615\text{N/mm}^2}}$$






Variables Used

- f_s Design Factor of Safety
- m Slope of modified Goodman Line
- M_{ba} Bending Moment Amplitude (*Newton Millimeter*)
- M_{bm} Mean Bending Moment (*Newton Millimeter*)
- P_a Force Amplitude for Fluctuating Stress (*Newton*)
- P_m Mean Force for Fluctuating Stress (*Newton*)
- S_a Limiting Value of Stress Amplitude (*Newton per Square Millimeter*)
- S_e Endurance Limit (*Newton per Square Millimeter*)
- S_m Limiting Value of Mean Stress (*Newton per Square Millimeter*)
- σ_a Stress Amplitude for Fluctuating Load (*Newton per Square Millimeter*)
- σ_m Mean Stress for Fluctuating Load (*Newton per Square Millimeter*)
- σ_{ut} Ultimate Tensile strength (*Newton per Square Millimeter*)
- σ_{yt} Tensile Yield Strength for Fluctuating load (*Newton per Square Millimeter*)



Constants, Functions, Measurements used

- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Torque** in Newton Millimeter (N*mm)
Torque Unit Conversion 
- **Measurement: Stress** in Newton per Square Millimeter (N/mm²)
Stress Unit Conversion 



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