- $Total\ Internal\ Work = \frac{V^2 h}{2E}\left[\left(\frac{1}{wL\sin^2\alpha\cos^2\alpha}\right) + \left(\frac{1}{2A_c\tan^2\alpha}\right) + \left(\frac{h\tan^2\alpha}{LA_b}\right)\right]$ $(equation\ 1)$.
- Final form: $$\frac{\left[\frac{2}{(wL)}+\frac{1}{A_C}\right]}{\left[\frac{2}{(wL)}+\frac{2h}{A_bL}\right]} = (\tan^4\alpha)$$ *(equation 2).*

Where V, h, Ac, L and Ab are material properties and can be considered as constants.

Differentiate the function with respect to alpha (α) and set it to 0 to find the maximum value. Using double angle identities and writing the functions in terms of sin and cos:

- $\frac{d}{dx}\left(\frac{1}{wL\sin^2\alpha\cos^2\alpha}\right) = \frac{-8\sin(4\alpha)\csc^4 2\alpha}{wL} = \frac{2}{wL\sin\alpha\cos^3\alpha} - \frac{2}{wL\cos\alpha\sin^3\alpha}$
- $\frac{d}{dx}\left(\frac{1}{2A_c\,tan^2\,\alpha}\right) = \frac{-\cot\alpha\csc^2\alpha}{A_c} = \frac{-\cos\alpha}{\sin^3\alpha A_c}$
- $\frac{d}{dx}\left(\frac{h\,tan^2\,\alpha}{LA_b}\right) = \frac{2h\tan\alpha\sec^2\alpha}{A_bL} = \frac{2h\sin\alpha}{\cos^3\alpha A_bL}$
- $\frac{d}{dx}\left(\frac{h^4\,tan^2\,\alpha}{360L^2I_c}\right) = \frac{h^4\tan\alpha\sec^2\alpha}{180I_cL^2} = \frac{h^4\sin\alpha}{180I_cL^2\cos^3\alpha}$

$\therefore$

- $0 = \frac{2}{wL\sin\alpha\cos^3\alpha} - \frac{2}{wL\cos\alpha\sin^3\alpha} - \frac{\cos\alpha}{\sin^3\alpha A_c} + \frac{2h\sin\alpha}{\cos^3\alpha A_bL}$
- $\frac{2h\sin\alpha}{\cos^3\alpha A_bL} + \frac{2}{wL\sin\alpha\cos^3\alpha} = \frac{2}{wL\cos\alpha\sin^3\alpha} + \frac{\cos\alpha}{\sin^3\alpha A_c}$

Factoring out $\frac{1}{\sin^3\alpha}$ and $\frac{1}{\cos^3\alpha}$ from RHS and LHS respectively:

- $(\frac{1}{\cos^3 \alpha})[\frac{2h \sin \alpha}{A_b L} + \frac{2}{wL \sin \alpha}] = (\frac{1}{\sin^3 \alpha})[\frac{2}{wL \cos \alpha} + \frac{\cos \alpha}{A_c}]$
- $(\tan^3 \alpha)[\frac{2h \sin \alpha}{A_b L} + \frac{2}{wL \sin \alpha}] = [\frac{2}{wL \cos \alpha} + \frac{\cos \alpha}{A_c}]$
- $(\tan^3 \alpha)(\sin \alpha)[\frac{2h}{A_b L} + \frac{2}{wL \sin^2 \alpha}] = (\cos \alpha)[\frac{2}{wL \cos^2 \alpha} + \frac{1}{A_c}]$

Finally, rearranging like terms:

$$\frac{\left[\frac{2}{(wL)\cos^2 \alpha} + \frac{1}{A_c}\right]}{\left[\frac{2}{(wL)\sin^2 \alpha} + \frac{2h}{A_b L}\right]} = (\tan^4 \alpha)$$