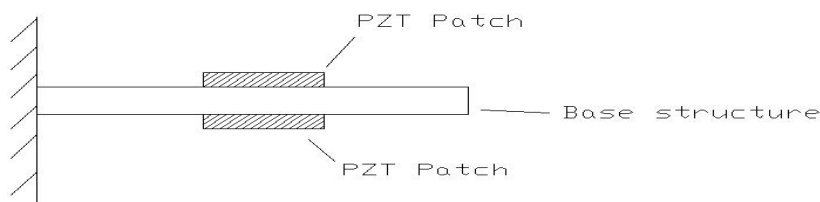


Project Proposal

ME 256 Variational Calculus And Structural Optimization

- **Background-**

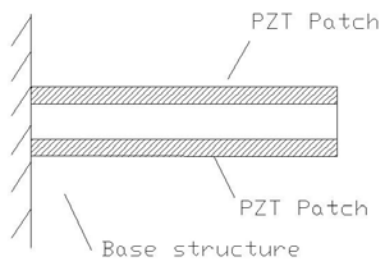
Smart Structure is a structure with sensory network. The data gathered can be used for health monitoring and applications like that. Sometime we need to give some corrective feedback to the structure; this can be done by attaching PZT actuators to the structure. So smart structure will have sensory network which will sense any abnormality (say crack growth in a composite lamina) or simply monitor the structure and based on the data provided by sensors; actuators can take corrective action. (Say release of fillers in near crack in composite lamina.)



As shown in the figure, we have a base structure on which PZT patches are attached.

Now problem is faced while fixing the patch on the base structure, what should be the thickness of the patch and what should be the length??

I am trying to address the problem of fixing the thickness of the patch. For the given $A(x)$ with loading $P(x)$ and E of a structure what should be the thickness (t_s) of the PZT patch? I am assuming that the patch covers the complete span of the beam.



- **Problem Statement**

Maximize
$$\int_0^L \left\{ \frac{(P+2E_a \epsilon_a) t_a b}{2E_a t_a b + E_s t_s b} \right\} dx$$

$t_a(x)$

Subject to

$$\int A_a dx - V^* \leq 0$$

$$(E_s A_s u')' + P = 0$$

maximize normalized tip deflection (delta tip/ length) wrt $t_a(x)$ actuator thickness.

P is load applied ; function of x

E_a actuator young's modulus

ϵ_a actuator strain

t_a actuator thickness

b width of cantilever

E_s base structure young's modulus

t_s base structure thickness

L span of cantilever beam.

- **Analytical Solution**

I will submit it later.

- **Plan for further work**

I am planning to solve the problem by discretizing it and will note the effect.

Certainly your guidance for the further work will be of more importance.

Submitted by

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