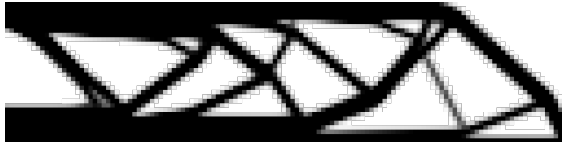


AML7870 - Topology and shape optimization

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Term projects
January 19, 2026
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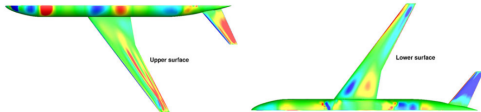


Shape optimization in aerodynamics

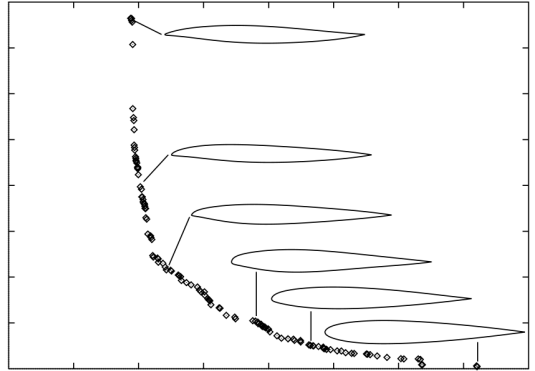
- Optimize an airfoil with some objective pressure distribution

$$J = \int (p - p_t)^2 dS$$

- Perform a wind-tunnel validation of the designed airfoil
- Design a wing-fuselage combination for aerodynamic performance (minimize drag)

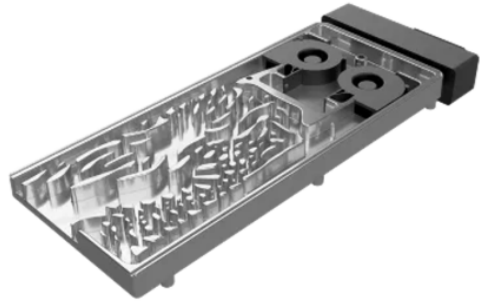


*all figures are taken from different sources



Optimization of a heat-sink

- Optimization of a heat sink for maximizing the convection coefficient in a given flow configuration
- Optimize a heat sink with manufacturing constraints.



- Multiobjective optimization with minimizing coolant pressure drop and maximizing heat transfer coefficient

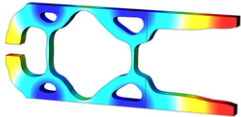
*all figures are taken from different sources

Optimization of a structure

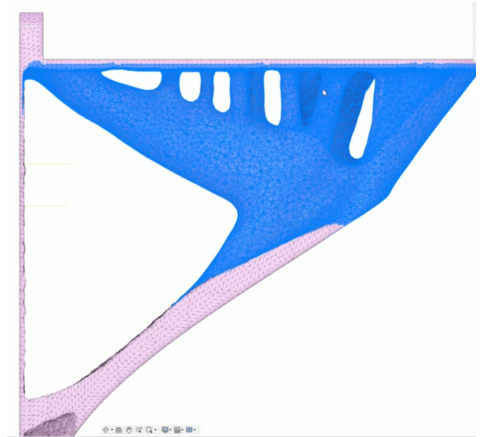
- Topology of a book-shelf support. Minimize compliance with a volume constraint and 3D print it

$$\min \int \mathbf{f} \cdot \mathbf{u} d\mathbf{x}$$

- Optimization of a compliant mechanism. 3D print it and test it for the design constraints and performance.



*all figures are taken from different sources





Paper review

- Review seminal papers in the field – truss topology optimization, aerodynamic optimization, microfluidic device optimization, SIMP method, etc
- Reproduce a major result of the paper.
- Formulate a simpler problem based on the paper's methods and solve it completely.



Evaluation (30% of total)

For designing of a part

- Clarity of the constraints and methodology used (10%)
 - Command over tuning parameters and their values (especially if a commercial software was used) (20%)
 - Real world performance evaluation (30%)
 - Presentation and Report (25%)
-
- All the presentations will be held immediately after the major exams
 - All the reports will be due on the day of the presentation
 - 0 marks (in whole 25%) if
 - Report not submitted
 - Not presented
 - Not attended presentations/no class participation during others' presentation

For paper review

- Clarity over the methodology developed along with mathematical details (10%)
- Command over tuning parameters and their values (especially if a commercial software was used) (20%)
- Result reproduced and how it helps the general community (30%)
- Presentation and Report (25%)