



Task 1: Selection basics

Instructions: Check the following questions and exercises. Read chapters 3, 4, and 5 of the course textbook (4th edition available in the Aalto Library as an e-book).

Criterion: A good report on this task demonstrates a good understanding of:

- how to **derive** a **material performance index** from the formulation of a performance objective,
- how to **use** a **material performance index** in material selection, and
- how to graphically represent this with **material selection lines** on the **material property map**

Task 1.1: Read the case study 6.2 “Materials for Oars” from the textbook.

Now follow the same method to choose one material from the material group listed below for a wind turbine blade. In the simplest case, the blade is a beam in bending. It should be as light as possible and have a given bending stiffness.

- First, define the **design requirements** in a table, including functions, constraints, objectives, and free variables, etc.
- Secondly, derive the formula for the material performance index from the performance objective. Note that the **derivation** (step-by-step) of the material performance index **must** be included in your report.
- Then draw the **maps** with level 2 and explain what the correct material **selection lines** are for this task.

Hint: Draw the Material Selection Maps on level 2 with density and Young’s modulus as axes.

Composites	Plastics
Foams	Non-technical ceramics
Metals	Technical ceramics
Elastomers	Natural materials

Task 1.2: Draw the maps from Task 1.1 on level 3. What differences do you notice? Give a detailed description based on your observation.