

Characterizing Engine Performance with BSFC Maps

Orientation:

Fuel consumption between different engines can be compared by expressing fuel consumption data on a specific basis (i.e. dividing fuel consumption by brake power) and then plotting these data against bmep as well as mean piston speed. This results in a three-dimensional surface that can be reduced to contours of constant brake specific fuel consumption (bsfc). BSFC maps identify maximum fuel efficiency points as well as operating conditions surrounding all points on the torque curve.

Learning Objectives:

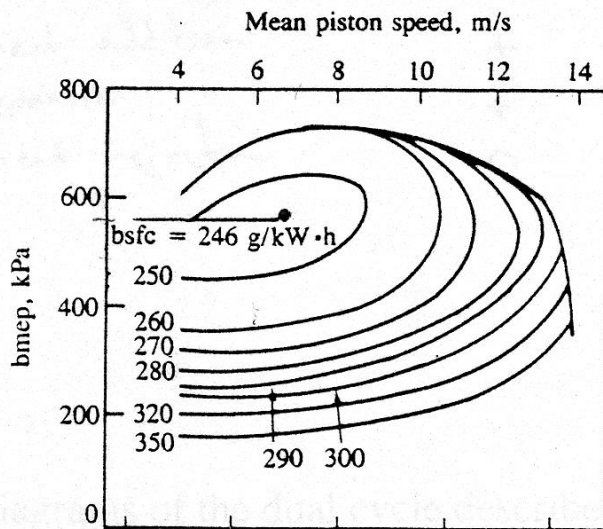
1. Write equations for engine power, torque, and fuel consumption using bsfc map data.
2. Brainstorm phenomena responsible for local minima on bsfc maps.

Targeted Skills:

Diagramming – clarifying relationships through visual representations

Integrating – combining parts into a new whole

Reasoning with theory – explaining data with accepted knowledge



- a) Outline how to determine the engine speed at the minimum bsfc point, beginning with information on the chart. In developing your equations, assume that you know the engine geometry/configuration (bore, stroke, number of cylinders, and number of revolutions/power stroke). Write an equation and define your variables.

- b) Outline how to determine the brake torque at the minimum bsfc point.
Write an equation and define variables needed, beginning with data from the bsfc map.
- c) Outline how to determine the brake power at the minimum bsfc point.
Write an equation and define variables needed, beginning with data from the bsfc map.
- d) Outline how to determine the fuel flow rate at the minimum bsfc point.
Write an equation and define variables needed, beginning with data from the bsfc map.
- e) Assuming a fuel heating value of 44 MJ/kg, what is the numerical value of the arbitrary engine efficiency at the minimum bsfc point?
- f) Provide an explanation why bsfc increases as you move away from the minimum point in all four directions (left, right, up, and down). For the purposes of this discussion, assume that this is a diesel engine.