Problems on EDC given at exams in "Turbulent combustion, mass and heat transfer" , 1993-2000.

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Chapter 11 Magnussen's Eddy Dissipation Concept was not included in the reading list of TEP4170/SIO1073 Heat and Combustion Technology in the years 2001-2015, but included from 2016. The chapter (or a draft version) was included in 61161Turbulent combustion, mass and heat transfer from 1993 to 2000.

All exams were 4 h and had 12 problems (except 1993). Problems were given in Norwegian.

May2000, 1c :

Two models that are in use for turbulent combustion are Magnussen's Eddy Dissipation Concept (EDC) and Flamelet models.

- Mention important and characteristic aspects of EDC

(and 1d: Explain main points of flamelet models)

May 1999, 3c-d:

c) In Magnussen's combustion model. EDC, the following expression appears:

$$-R_k^* = \rho^* \dot{m}^* \chi (Y_k^o - Y_k^*)$$

- Show how this is achieved and explain the meaning of each symbol.

d) With some development, Magnussen arrives at

$$-\overline{R}_k = \frac{\overline{\rho}\dot{m}\chi}{1-\gamma^*\chi}(\tilde{Y}_k - Y_k^*)$$

-Show how this expression will become when we assume "(infinitely) fast reaction" and that we account fuel, oxidizer and product as the "species" of the reaction.

May 1998: no questions on EDC

May 1997, 3a:

In Magnussen's combustion model EDC, the reaction rate is modeled as

$$-\overline{R}_k = \frac{\overline{\rho}\dot{m}\chi}{1-\gamma^*\chi}(\tilde{Y}_k - Y_k^*)$$

-What are $\dot{m}$, γ^*, χ and Y_k^*?

-How do we determine Y_k^* for infinitely fast chemistry and for finite-rate chemistry?

May 1996, 3c-d:

c) Explain about the reactor model of Magnussen's Eddy Dissipation Concept.
d) Explain how the expression

$$\bar{R}_{\mathrm{fu}} \sim \tilde{Y}_{\mathrm{min}}, \quad \text{where } \tilde{Y}_{\mathrm{min}} = \min\left[\tilde{Y}_{\mathrm{fu}}, \tilde{Y}_{ox} / r\right]$$

is achieved. (The symbol ~ denotes "proportional to").

June 1995: no questions on EDC

June 1994, 3c-d = May 2000 1c-d

June 1993, 3a-d (4 of 16 problems, 4 hours)

Magnussen's combustion model Eddy Dissipation Concept (EDC)

a)Mention the main points of EDC

b)Show how he by a reactor model achieved

$$-\bar{R}_k = \frac{\bar{\rho}\dot{m}\chi}{1-\gamma^*\chi}(\tilde{Y}_k - Y_k^*), \qquad \text{given} \quad (Y_k^o - Y_k^*) = \frac{(\tilde{Y}_k - Y_k^*)}{1-\gamma^*\chi}$$

c)Show how this model is simplified if an infinitely fast, one-step reaction is assumed

d) How is extinction modeled in EDC?