

International Perspective on Collaborative Research and Education

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Position of Denmark



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Copenhagen - Kobenhavn

CAPEC



DTI

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Collaboration: Incentives - Needs

Externally sponsored (EU, UN, ...)

EU-ERASMUS (encourage mobility of students)

EU-Research projects (ITN, NMP-big, NMP-small,)

Bilateral

Country level University – Department level Research center/group/faculty level





Countries

Universities/departments

Research centers/groups

Individuals

SMART CN Workshop on Sustainable Manufacturing, Pittsburg, October 31, 2012





Education

Summer schools, workshops, courses ... Research Visiting researchers (informal) Exchange of visits (formal) Faculty/postdoc PhD students **MSc** students



Model based framework



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Property models

$$Log P_i = A_i + [B_i/(C_i + T)]$$



Process models

$$\frac{dm_i}{dt} = f_{in,i} - f_{out,i} - r(m,T,P)V; i = 1, NC$$





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Models and relationships



To solve problem: supply $\underline{\beta}^*$, $\underline{\theta}$, \underline{C} , \underline{f} , \underline{d} ,

<u>u*, y</u>*

Models: **Process/product** $d\underline{x}/dt = f(\underline{f}, \underline{u}, \underline{d}, \underline{\theta}, \underline{x})$ $\underline{\mathbf{y}} = \mathbf{g}(\underline{\mathbf{x}}) - \underline{\mathbf{y}}^*$ $\underline{\beta} = \beta (\underline{C}, \underline{f}, \underline{x}) - \underline{\beta}^*$ **Sustainability Metrics** $\underline{S}_{e} = S_{e} (\underline{f}, \underline{u}, \underline{x}, \underline{y}, \underline{d}, \underline{\theta})$ $\underline{\mathbf{S}}_{i} = \mathbf{S}_{i} (\underline{\mathbf{C}}, \underline{\mathbf{f}}, \underline{\mathbf{x}}, \underline{\mathbf{y}}, \underline{\theta})$ $\underline{S}_{s} = S_{s}$ (size, profit, ?) Safety & Hazards $\underline{H}_{c} = Hc (\underline{C}, \underline{f}, \underline{x}, \underline{y}, \underline{d}, \underline{\theta})$ $\underline{Hp} = H_{p} (\underline{u}, \underline{f}, \underline{x}, \underline{d}, \underline{\theta})$







Issues

- System boundaries
- Models (of different types, sources,)
- Data (from different sources,)
- Multi-objective & multi-discipline

Collaboration = systematic solution of problems by efficient management of the complexity



CAPEC collaboration activities 2012

- 4 Number of faculty members
- **30-36** Total number of personnel

CAPEC

- 16 Number of current PhD students
- 12 Number of visitors (students, postdocs,)
- **13** Number of countries representing CAPEC personnel
- 3 Number of active EU-funded projects
- **10** Number of international active collaborations within academia
- 31 Number of active collaboration agreements with companies
- > 70 Number of academic licenses for ICAS (CAPEC software)
- 7 Number of workshops, summer schools, short courses, ..
- 14 Countries represented in the CAPEC industrial consortium

