Wrocław University of Science and Technology

Department of Cybernetics and Robotics

Scientific & Engineering Programming

Specification and implementation of systems/experiments. Outroduction

Robert Muszyński

Scientific & Engineering Programming

Scientific – related to science

science – knowledge about the natural world

scientist – a person learned in science

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engineering – application of science and mathematics in nature

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Programming – related to programs

programming – the act of creating computer programs

programmer – one that programs

Scientist & Engineer Needs

- acquire knowledge
- describe nature
- predict behaviors

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- acquire knowledge
- describe nature
- predict behaviors
- invent machines
- design machines
- analyze machines
- build machines
- test machines
- keep machines running

Scientist & Engineer Process Cycle & Tasks

The cycle

- pre-processing — defining the model and environmental factors
- analysis – understanding, verification
- post-processing of results – visualization

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Tasks

- modeling
- simulation
- visualization

Engineering – Tasks

Definition (Merriam-Webster Dict.)

The application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people

Engineering – Tasks

Definition (American Engineers' Council for Professional Development)

The creative application of scientific principles

- to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination

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all as respects an intended function, economics of operation and safety to life and property

Three remarks on Creativity

Definition

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creativity – the state of the body enhanced by the "acid",
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(Great Internet Multimedia Encyclopedia – IKNOW)

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nowadays, one can learn creativity during a three day training

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Verity

no, one can't!

Creativity versus Creahativity

Creahativity — Creativity + ah

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Definitions

creativity – the sex appeal of the intellect (Joseph O'Connor)

ah – interjection, used to express delight, relief, regret, or contempt (Merriam-Webster)

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  joy, surprise, fear, sadness
  – emotions! spontaneous reaction

Engineering – Tasks

- design
- construction
- modification
- analysis
- operation

Engineering – Background

- sciences
- mathematics
- modeling (mathematical)

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- experience
- tacit knowledge

Engineering – Methodology

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- problem understanding and specification
- solutions elaboration
- solutions evaluation and choice
- constraints identification, understanding, and interpretation

Engineering – Tools

- prototypes
- scale models
- simulations
- destructive tests
- nondestructive tests
- stress tests
- failed products

Science – Tasks

Definition (Merriam-Webster Dict.)

- knowledge

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- prototypes
- scale models
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- . . . tests
- . . . tests
- . . . tests
- more tests

So what?

What should scientists and engineers do?

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think

So what?

What should scientists and engineers do?

think

experiment

So what?

What should scientists and engineers do?

think

experiment

Why to think?

So what?

What should scientists and engineers do?

think

experiment

Why to think?

it does not hurt?!

So what?

What should scientists and engineers do?

think

experiment

Why to think?

it does not hurt?!

Why to experiment?

So what?

What should scientists and engineers do?

think

experiment

Why to think?

it does not hurt?!

Why to experiment?

experiments answer questions

So what?

What questions do scientists ask?

So what?

What questions do scientists ask?

why?

So what?

What questions do scientists ask?

why?

What questions do engineers ask?

So what?

What questions do scientists ask?

why?

What questions do engineers ask?

how?

So what?

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why?

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how?

scientists study the world as it is; engineers create the world that has never been

Theodore von Kármán