



Digested Problem Report



- Organic computing
- Modeling
- Applications
- Application constraints
- Computing
- Problem decomposition
- Integration of subsystems
- Robustness
- Networks
- Evolution
- Purpose
-

Features of Organic Computing



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- Analogue?
- Self configuration
- Systems that reconstruct themselves
- Incomplete planning
- Exploit properties of subsystems
- Active elements
- Interaction with surprising environment
- Adaptivity
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Modeling living systems



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- Mass of data is a burden
- Close interaction between model and experiment is missing
- Level of modeling
 - Molecule
 - subcellular
 - cellular
 - networks of cells
 - whole system
- technical applications
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Algorithmic	Organic
Accounting Text editing Baggage handling Metro steering	Semantic text editor Baggage handling
	Vision Perception HCI Robotics

Application constraints



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- Better Computers no use without better concepts
- Who wants software with a mind of its own?
- Have plenty of that already!
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- Turing machine is very powerful model
- Is there a different notion of computation?
- Continuous systems are more powerful than Turing machines
- Is universality really a good thing?
- Alternatively systems with known good properties ...
- Will one be content with these?
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Problem decomposition



- KISS to catch the essence of a problem
- How the cell system can be decomposed seems quite unclear
- Simple decomposition usually destroys the interesting properties
- Software engineering has done a good job at decomposition
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Integration of subsystems



- Create simple small models, combine into big ones
- Networks of cellular processes are actually known
- This looks better than in brain
- There are nice results on small systems but they do not scale up
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- Feedback loops aid robustness
- Replication of sequences with slight modifications
- Adaptation
- How to decide if a model/system is robust
- doesn't break down when messed around with
- In real world problems there is no noise model
- Which perturbations may matter, which may not?
- Environment is constrained
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- Network a paradigm to replace algorithm?
- cell cycle regulation networks
- signaling cascades involved in tumor generation
- General network theory
- Communication is crucial
- Even brains need networking via language and social interaction
- Complexity is highly desirable, but hard to manage (INTEL example)
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Evolution



- Force evolution to remain in a reasonable space
- Evolvability is important
- Adaptivity on different time scales
- Evolution can be boosted through memory
- Speed of progress in software engineering is breathtaking as compared to evolution
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Purpose



- Living cells have a purpose
- Algorithms have a purpose
- Flying bees have a purpose
- Teleological machines
- Brain is general purpose, computer is not
- Computer is general purpose, brain is not
- **How to impose your own will (purpose) on a machine with as little effort as possible?**
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