Questions

- Traditional scientific and engineering approach includes only theory and experiment. List at least three disadvantages/limitations of such approach, which could be managed by adding the computational simulations.
- List two general approaches of modelling; what is the difference between them? Explain this difference.
- Formulate the Moore's Law. How does the Moore's law affects the sensors number?
- List at least three applications of scientific computing; justify with examples.
- List the computational methods in terms of physical sizes scale (macro to nano)
- List the HPC units; explain the meaning of each one.
- What will happen when the transistor size shrinks by some factor x? Explain in terms of clock rate, unit area, raw computer power and shrinkage of performance of the program.
- Explain the terms of parallel speedup and parallel efficiency.
- List the principles of parallel computing. Explain each of them in a few words.
- Explain the overhead of Parallelism.
- Explain what do the terms "load balance"and "load imbalance"mean? By what can be the imbalance caused?
- What kind of parallel computing resources do you know? List them and justify the answer: why the listed resources can be considered parallel?
- List at least five applications demanding parallel computations. Justify your answer.
- List the limitations of serial computing. Explain each one in a few words.
- Describe the von Neumann architecture.
- List the main principle of writing a good code.
- Which kinds of software we have to use in order to write a solver for a complicated problem? Which ways (in relation to these kinds of software) can be used for optimization of your program?
- Explain the meanings of shared and distributed memory.
- What is the difference between MPI and OpenMP? Describe both.
- Explain the computational problem in terms of phenomenon, input and output.
- What is the residual? How can we describe some phenomenon with residual?
- What is the input of the phenomenon, both non-mathematical and mathematical?
- What is the mathematical model and how can it be represented?
- In which form the output (or observed) data may be presented? Justify the answ
- What is the forward problem, and what is inverse problem? What is the differen

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- Give any example of the Forward (simulation) problem; explain the example, explain why is the example is a forward problem.
- Give any example of the Inverse problem; explain the example, explain why is the example is a forward problem.
- List the applications of Forward and Inverse problems.
- Describe two approaches of simulation of complex system.
- Why it is sometimes hard to classify the problem in terms of Forward and Inverse problems?
- List three points J.Hadamard proposed to consider in order to classify problems in terms of well- and ill-posedness.
- List the ways of additional measures you can apply to solve the ill-posed problem.
- What does the continuous dependence of the solution on input means?
- List the possible problems for the inverse operator in case of ill-posed problems.
- What is ill-conditioned problem? Define it both mathematically and non-mathematically.
- Give any example of ill-conditioned problem. Explain it.
- Define static and dynamic problems. Give at least two examples of each and explain these examples.
- List the cases in which a dynamic problem may be considered to be a static one. Explain these cases.
- Write the definitions of deterministic and stochastic problems. Give at least two examples of each kind. Explain, why these examples can be considered as static or dynamic.
- Provide an example of the problem, which can be considered both in deterministic and stochastic ways. Explain the example.