

## **Assignment #3: Critical Review on the seminar “Multi-Level Monte Carlo Methods” by Gabriel Bugada**

**Communication Skills I – Year 2016 – 2017**

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As an introduction the lecturer pointed out the necessity of Monte-Carlo simulations (“MC”) due to the amount of uncertainties of many values in real life problem solving. The MC is providing many possible outcomes by changing and recombining several parameters in a set of problems in order to facilitate risk management and to anticipate possible consequences. The generated values are analyzed in a classical deterministic way and are used for calculation of mean values and variances.

The different MC-methods were explained, beginning with the standard variation and a matching test case, which was showing the different reference levels of accuracy and approximation. The values, shown in plots, were oscillating around a mean value, which was specific for every scenario and which showed the dimension of uncertainty when calculating with numbers which were not accurate enough. The finer the mesh the more computation time was required. To obtain an accurate result, both a big number of samples, a convergence with 500 shots is acceptable, and long computation time is needed.

Furthermore an introduction to Multi-Level Monte Carlo (“MLMC”) was given, which needs a big number of sampling points in order to provide a good statistical representation of the stochastic solution. The more uncertainties the more sampling points should be considered. The difference between MC and MLMC is that a lot of analysis with a low level of resolution is combined with only few analysis with a high level of resolution. The target is to lower the total costs of the classical MC. In different stages the level of accuracy is raised until it reaches the mean value of classical MC, but with a lot less computational time. For a robust design the variance has to be minimized by using generic algorithms and other parameters have to be considered.

The structure of the presentation was quite clear. The lecturer began with the basic knowledge about MC, even though the presentation was clearly not prepared for laymen, and increased the level of specification and details as he moved on. Also he managed to combine theory and test cases in a comprehensible way and finished the presentation with his conclusions. The slides were sometimes a little bit too crowded with text, so it was sometimes

too distracting to deal with the amount of text on the slide and at the same time following his words, but the way of holding the presentation was following the guideline “as simple as possible, as complex as necessary”.