Virtual experiments on an IP laboratory measurement

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Abstract
Carrying out laboratory experiments is usually a time-consuming process. In addition, the options for varying parameter studies are limited and adjustments to the design of the measuring equipment are often not possible at all. In order to circumvent these limitations, we supplement our laboratory experiments with virtual experiments as best as possible. For this purpose, we have expanded our finite element library FEMALY [1] to include the so-called complete electrode model [2], which allows us to simulate electrodes of any shape for DC and IP applications and also provides us with explicit mathematical expressions for calculating sensitivities [3].

As a first case study, we consider an IP measurement on a measuring cylinder with embedded ring electrodes to virtually reproduce the time-varying change of the apparent resistivity for laboratory tracer experiments (Figure 1). We present the real and imaginary part of the sensitivity distribution of the underlying measurement configuration that confirms our initial assumption that the actual electrode surface shape has a relatively small influence on the observed measurement quantities.

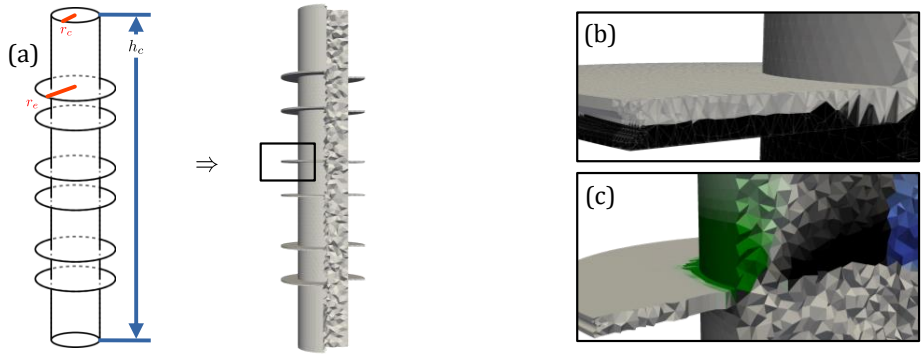

Figure 1: (a) Sketch of the measurement cell and its discretization with ring electrodes embedded in the mantle of the six cylindrical slices. (b) Detail of the discretization showing the parameter distribution at the upper of two potential electrodes (small pos. real & small neg. imag. part – white, large pos. real & large neg. imag. part – black). (c) Associated sensitivity distribution at the transition between the cylindrical slices and the measurement cell for a current injection at the circular cell faces (neg. real part – green, pos. real part – black, neg. imag. part – blue).

Reference
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