



## TIME SCALE CALCULUS – ADVANCES IN SYNTHETIC SEISMOGRAM CALCULATIONS

Kamil WASKIEWICZ<sup>1</sup> and Wojciech DEBSKI<sup>2</sup>

Synthetic, numerically generated seismograms are one of the key factors of any interpretation of recorded seismic data. At the early stage of development, calculation of full seismic waveforms was impossible due to a limited computational resource so we were forced to use only some selected characteristics of seismic waves relatively easy for numerical calculations like first arrival times, maximum amplitude, approximate source spectra, to name a few. Continuous development of computational resources as well as progress in numerical techniques has opened possibilities of generation of the full, 3-component seismograms incorporating many physically important elements like wave attenuation, anisotropy or randomness of the media. Although achieved results are impressive we still need new numerical methods to tackle existing problems with the synthetic seismogram generation. In this contribution we present a novel approach to discretization of the wave equation which brings together continuous and discrete numerical analysis of the seismic waves. The foundations of this new technique, called **Time Scale Calculus**, have been formulated by Hilger in the late eighties and is very dynamically developing. The Time scale calculus, due to its universality seems to have a great potential when practical applications are considered. Thus we have decided to bring the Time Scale calculus concept closer to geophysical, or more precisely to seismological applications. This presentation is intended as a basic introduction to the time scales calculus considered from a seismological point of view. We shortly present and discuss the possibility of using the Time Scales (TS) technique for solving the simplest acoustic 2D wave equation keeping in mind its particular applications for mining induced seismicity.

---

<sup>1</sup> Institute of Geophysics Polish Academy of Sciences, Warszawa, kamilwas@igf.edu.pl

<sup>2</sup> Institute of Geophysics Polish Academy of Sciences, Warszawa, debski@igf.edu.pl