

## Introduction

The research project “Seismic waves in complex 3–D structures” (SW3D) started on October 1, 1993. The project reached the end of its twenty–sixth year on September 30, 2019, and still continues.

The Volume 29 of the serial *Seismic Waves in Complex 3–D Structures* of the annual reports of research project “Seismic waves in complex 3–D structures” summarizes the work done in the period December, 2018 — December, 2019. It also includes the DVD compact disk with updated and extended versions of computer programs, with brief descriptions of the programs, and with the copy of the SW3D research project WWW pages containing papers from previous volumes and articles from other journals.

Our group working within the project during the twenty–sixth year has consisted of six research workers: Václav Bucha, Petr Bulant, Vlastislav Červený, Luděk Klimeš, Ivan Pšenčík and Bohuslav Růžek. Ivan Pšenčík is the supervisor of PhD students Miłosz Wcisło, with the PhD thesis on “Seismic waves in inhomogeneous, weakly dissipative, anisotropic media”, and Han Xiao of Jilin University, China, who works on the inversion of reflection seismic data in anisotropic media.

Dirk Gajewski (University of Hamburg, Germany), Xingguo Huang (University of Bergen, Norway), Einar Iversen (University of Bergen, Norway), Morten Jakobsen (University of Bergen, Norway) and Petr Jílek (BP–America, Houston, USA) visited us since the publication of the preceding Volume 28 in December, 2018.

During the twenty–sixth year of the project, Ivan Pšenčík served as a guest editor of the special part of Geophysical Prospecting devoted to the proceedings of the 18th International Workshop on Seismic Anisotropy in Kibbutz Ma’ale Ha’Hamisha near Jerusalem in November 2018.

The Research Programme for the twenty–fourth year of the SW3D research project, published in the Volume 27 of the serial *Seismic Waves in Complex 3–D Structures*, has not been updated yet. More detailed information regarding the SW3D research project is available online at “<http://sw3d.cz>”.

The **Volume 29** contains mostly the papers related to seismic anisotropy (3 of 4 papers). The other paper is devoted to attenuation. The Volume 29 may roughly be divided into four parts, see the Contents.

The first part, **Velocity models and inversion techniques**, is devoted to various kinds of inverse problems, to the theory developed for application to their solving, and to constructing velocity models suitable for ray tracing and for application of ray–based high–frequency asymptotic methods.

In their contribution “P–wave reflection–moveout approximation for horizontally layered media of tilted moderate orthorhombic symmetry”, V. Farra & I. Pšenčík apply the approximate reflection moveout formula (analytic approximation of travel times of reflected waves), derived in the corresponding article of the preceding Volume 28, to layered media composed of horizontal orthorhombic, transversely isotropic or isotropic layers, and test the formula numerically. The anisotropy of individual layers may have an arbitrary tilt, which may differ from layer to layer. The performed tests of the formula indicate that its accuracy is similar to the accuracy of formulae for single layers studied in the preceding volumes of the serial *Seismic Waves in Complex 3–D Structures*.

In his paper “Kirchhoff prestack depth scalar migration of complete wave fields in simple inhomogeneous weakly anisotropic velocity models: PP, PS1 and PS2 waves”,

V. Bucha continues and extends the related paper of the Volume 28 in which he used the common S-wave approximation to migrate the S wave. He now applies also the prevailing-frequency approximation of the coupling ray theory to migrate the S wave, probably the first time worldwide. For comparison, he calculates also the migrated sections using the anisotropic-ray-theory approximation of S waves. In the paper of the Volume 28, V. Bucha used inhomogeneous weakly anisotropic velocity model QI, whereas now he tests also velocity model QI4 with stronger anisotropy.

The second part, **Elastic waves in anisotropic media**, addresses the problems relevant to heterogeneous anisotropic elastic media.

During the ray-based Kirchhoff migration of a complete wave field presented in the preceding Volume 28, V. Bucha encountered problems with stair-step migrated interfaces. The synthetic recorded wave field was calculated using the 3-D seismic modelling code for inhomogeneous media of arbitrary anisotropy by Ekkehart Tessmer. V. Bucha now reveals the causes of these artefacts in the migrated sections in his paper “Kirchhoff prestack depth scalar migration of a complete wave field: stair-step”.

The third part, **Elastic waves in isotropic attenuating media**, is devoted to waves propagating in isotropic attenuating media.

The contribution of I. Pšenčík, M. Wcisło and P.F. Daley, “SH plane-wave reflection/transmission coefficients in isotropic, weakly attenuating media” closely follows, especially in its theoretical part, the contribution with a similar title published in the preceding Volume 28. The reason for the repeated publication is completely different part of the numerical tests and, due to it, the conclusions. The last year contribution contained distorted results caused by a bug in the code for calculating R/T coefficients in attenuating media. The last-year problem led in the present version to a more detailed analysis of theoretical results, and to a comparison with the results obtained by an independent method of calculating R/T coefficients in attenuating media, which allows a better estimate of the accuracy of the proposed method.

The fourth and final part, **DVD-ROM with SW3D software, data and papers**, contains the DVD-R compact disk SW3D-CD-23.

Compact disk SW3D-CD-23, edited by V. Bucha & P. Bulant, contains the revised and updated versions of the software developed within the SW3D research project, together with input data related to the papers published in the serial *Seismic Waves in Complex 3-D Structures*. A more detailed description can be found directly on the compact disk. Compact disk SW3D-CD-23 also contains over 540 complete papers from journals and previous volumes of the serial *Seismic Waves in Complex 3-D Structures* in PostScript, PDF, GIF or HTML, and 2 older books by V. Červený and his coauthors in PDF. Refer to the copy of the SW3D research project WWW pages on the compact disk. Compact disk SW3D-CD-23 is included in the Volume 29 in two versions, as the UNIX disk and DOS disk. The versions differ just by the form of ASCII files.

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