

# Contents

<b>Introduction</b>	<b>1</b>
<b>1 A source time reversal method for seismicity induced by mining</b>	<b>6</b>
1.1 Introduction . . . . .	6
1.2 Previous results . . . . .	9
1.3 Model assumptions and the time-reversal method . . . . .	11
1.3.1 Example of an exact reconstruction . . . . .	14
1.4 Source time reversal (STR) method . . . . .	14
1.5 Numerical results . . . . .	23
1.5.1 Numerical implementation . . . . .	23
1.5.2 Influence of the smoothness of space- and time-term of the source on the reconstruction . . . . .	24
1.5.3 Sensitivity of the reconstruction with respect to $g(t)$ . . . . .	26
1.5.4 Influence of the reconstruction with respect to $c_0$ . . . . .	27
1.5.5 Seismicity experiments . . . . .	30
1.5.6 Mining configuration experiment . . . . .	33
<b>2 Source time reversal (STR) method for linear elasticity</b>	<b>35</b>
2.1 Introduction . . . . .	35
2.2 Framework . . . . .	37
2.3 Source time reversal in elasticity . . . . .	45
2.4 Implementation of the STR method . . . . .	48
2.5 Numerical experiments of STR with traditional regularization . . . . .	50
2.5.1 Two-dimensional phantom reconstruction . . . . .	50
2.5.2 Three-dimensional reconstructions with complete data . . . . .	51
2.5.3 Error decay analysis . . . . .	54
2.5.4 Tree-dimensional reconstruction with partial data . . . . .	54
2.5.5 Comparison of two STR regularization methods: traditional vs fast cut-off . . . . .	56
2.6 Numerical experiments of fast STR with cut-off regularization . . . . .	56
<b>3 Source detection in elastic waves for sources with temporal component of Dirac type</b>	<b>60</b>
3.1 Introduction . . . . .	60
3.2 Time reversal . . . . .	61
3.3 Detection of discrete-in-time sources for acoustics . . . . .	63

3.4	Extension to linear elasticity . . . . .	65
3.5	Implementation . . . . .	67
3.6	Numerical results with acoustic examples . . . . .	67
3.6.1	Reconstruction of two sources with smooth space term . . . . .	69
3.6.2	Reconstruction of three sources with discontinuous space term . . . . .	71
3.7	Numerical results with elastic examples . . . . .	72
3.7.1	2D reconstruction of two sources with smooth space term . . . . .	74
3.7.2	2D reconstruction of three sources with discontinuous space term . . . . .	76
3.7.3	3D reconstruction of two sources with smooth space term . . . . .	77
3.7.4	3D reconstruction of three sources with discontinuous space term . . . . .	78
	<b>Main achievements</b>	<b>78</b>
	<b>Conclusion</b>	<b>81</b>
	<b>Bibliography</b>	<b>84</b>