
Contents

1	Lower dimensional models in elasticity	7
1.1	Elasticity, in a rush	7
1.1.1	Some remarks on the energy density	10
1.2	Dimension reduction	11
1.2.1	Fundamental questions for low-dimensional models	13
1.3	Justifying lower dimensional theories	14
1.3.1	Previous work	15
1.3.1.1	Linear models	16
1.3.1.2	Nonlinear models	17
1.3.1.3	Prestrained models	18
1.3.2	A remark on shell theories	21
1.4	Outline	21
1.5	Acknowledgements	22
2	A hierarchy of multilayered plate models	25
2.1	The setting	25
2.2	Main results	33
2.2.1	The limit energies for a linear internal mismatch	35
2.3	Γ -convergence of the hierarchy	37
2.4	Γ -convergence of the interpolating theory	56
2.5	Approximation and representation theorems	64

3	Properties and characterisation of minimisers	69
3.1	Optimal configurations in the linearised regimes	69
3.2	The structure of minimisers for \mathcal{F}_{vK}^θ	79
3.2.1	Existence and uniqueness for $\theta \ll 1$	80
3.2.2	Critical points are global minimisers	86
4	Discretisation of the interpolating theory	93
4.1	Discretisation	94
4.2	Γ -convergence of the discrete energies	98
4.3	Discrete gradient flow	104
4.4	Experimental results	105
Appendix A	Auxiliary results	111
A.1	Some elementary matrix properties	111
A.1.1	The norm of a real matrix	111
A.1.2	Some matrix groups	114
A.1.2.1	A linearisation at the identity	116
A.1.2.2	The tangent space to $\text{SO}(n)$	118
A.2	On quadratic forms	119
A.3	On geometric rigidity and Korn's inequality	125
A.4	Convergence boundedly in measure	128
A.5	Γ -convergence via maps	129
A.6	Compactness and identification of the limit strain	132
A.7	Derivatives galore	134
A.7.1	A few computations	136
Appendix B	Notation	141
References		143