

List of Figures

P.1	An optimal conducting composite structure	xvi
P.2	Anisotropy of an optimal elastic structure	xvii
1.1	Oscillating minimizing sequence	5
1.2	Definition of convexity	8
1.3	Weierstrass variation	13
1.4	Oscillating minimizing sequence	15
1.5	Convexification of the Lagrangian and the minimizer	25
2.1	The refraction of the current and the field	40
2.2	The fields and the currents in a laminate	52
2.3	The field in coated circles	55
3.1	Various limits of materials layouts.	65
3.2	Conservation property of G -closure	71
3.3	G -closure in two dimensions	73
3.4	Domain of attainability, two dimensions	75
3.5	Domain of attainability, three dimensions	76
4.1	Problem of the best conductivity of a domain	82
4.2	Variation in a strip	94
4.3	Forbidden interval	96
4.4	The constitutive relations in the optimal medium	98
4.5	Convex nonsmooth Lagrangian	104
4.6	The constitutive equation for the optimal medium	106

4.7	The optimal annular conductors	108
4.8	Bar of the maximal torsion stiffness	111
4.9	Multiwell Lagrangians	112
4.10	Dependence of the volume M_2 on the cost γ_2	114
5.1	The local problem	128
5.2	An optimally conducting cylinder	135
5.3	Draft of the fields in the thermolens	137
5.4	Draft of the optimal thermolens	137
5.5	The fields in the optimal domain	138
5.6	Optimal project, conducting domain	138
6.1	A strong local perturbation of a potential	152
6.2	To the Weierstrass variation	153
7.1	A second rank laminate	175
7.2	Constructing an infinite-rank laminate	186
7.3	Matrix laminates	190
7.4	T-structure	197
7.5	Multicoated matrix laminates	198
9.1	Optimality conditions: A family of trial inclusions	245
9.2	Permitted regions of fields in an optimal composite	249
9.3	The fields in coated circles	254
9.4	The fields in matrix laminates	255
10.1	The scheme of bounding of a G_m -closure	264
10.2	Construction of L -closure	272
10.3	The L -closure of conducting materials, 2D	276
11.1	The G_m -closure in two dimensions	283
11.2	The G_m -closure in three dimensions	288
11.3	G -closure in three dimensions	291
11.4	Coupling: The isotropic component of the G_m -closure.	304
11.5	Coupling: Range of the anisotropic conductivities	306
11.6	Geometry of the “secured spheres”	307
12.1	Range of three-material composites	311
12.2	An extremal anisotropic three-component structure	312
12.3	Isotropic optimal multicomponent structures	318
12.4	Optimal three-component structures. Case I	319
12.5	Optimal three-component structures. Case II	321
12.6	Compatible composites from four materials. The fields	323
12.7	Compatible composites from four materials. Geometry	324
12.8	Permitted regions, based on single variations	327
12.9	Scheme of a composite variation	328

12.10	Permitted region \mathcal{V}_2 , based on composite variations	332
12.11	Permitted region \mathcal{V}_1 based on composite variations	333
12.12	The permitted regions, $\gamma = \gamma_1$	336
12.13	The permitted regions, $\gamma \in (\gamma_1, \gamma_2)$	336
12.14	The permitted regions, $\gamma = \gamma_2$	337
12.15	The permitted regions, $\gamma \notin [\gamma_1, \gamma_2]$	337
14.1	Stresses, applied to a unit square	361
14.2	Orthogonal matrix laminate of the second rank	383
14.3	Representation of tensors $\mathbf{t} \otimes \mathbf{t}$	388
14.4	Herringbone structure	390
15.1	Bounds on the stored energy	398
15.2	Structures of extremal stiffness	400
15.3	The upper W_L and lower W_p bounds of the energy	401
15.4	The quasiconvex envelope	403
15.5	Optimal periodic structures	415
15.6	Optimal cavities: Elongated periodicity cells	415
15.7	Why does the optimal cavity have corners?	417
15.8	Energy outside of the optimal cavity	418
15.9	The more cavities, the better	419
15.10	Optimal cavities, dependence on the loading	419
16.1	Hashin–Shtrikman bounds, Walpole points, and translation bounds: Well-ordered materials	428
16.2	Hashin–Shtrikman points, Walpole bounds, and translation bounds: Badly ordered materials	428
16.3	Hexagonal structures by Sigmund	430
16.4	An optimal polycrystal, differential scheme	454
16.5	Convergence of the family of bounds	456
16.6	Optimal fractal structure	458
17.1	A third-rank laminate	467
17.2	Optimal console, piece-wise constant properties	473
17.3	An optimal cylindrical shell	476
17.4	Example of an unstable design	481
17.5	The optimal beam under the “worst” loading	485
17.6	Optimal structure under multiple loading	487
17.7	Nonsmooth minimum	491
17.8	Optimal structure of a wheel	494