

## Index

- $\mathbb{R}\mathcal{G}$ -homomorphism, 220
- $\mathbb{R}\mathcal{G}$ -module, 210
- $\mathbb{R}\mathcal{G}$ -modules
  - isomorphic, 221
  - orthogonal, 221
- $\mathbb{R}\mathcal{G}$ -submodule, 217
- $d$ -realizable, 134
- adjacent, 49
- affine
  - span, 90
  - transformation, 33
- algebraic set, 176
- analytic function, 11
- Assur graph, 60
- bar, 62
- bipartite graphs, 58
- bipyramid, 161
- block-diagonalization, 231
- Bow's notation, 38
- bow-tie, 163
- Bricard octahedron, 157
- cable, 62
- Cayley graph, 252
  - cable defining set, 259
  - defining set, 258
- character of an  $\mathbb{R}\mathcal{G}$ -module, 213
- compatible, 19, 25
- concave, 39
- cone, 56
- configuration, 9, 11, 17
  - full dimensional, 23, 24, 34–36, 47, 48, 56, 156
  - universal, 90
- conjugacy class, 201
- conjugate, 201
- continuously differentiable, 47
- convex, 39, 49
  - hull, 49
- face, 49
- Farkas alternative, 68
- flex, 11
  - analytic, 11
  - continuous, 11
  - infinitesimal, 64
  - trivial, 11

- force
    - elementary, 67
    - external, 66
    - internal, 14, 29
    - resolved, 66
  - force density, 28
  - forces
    - equilibrium system, 34
    - resolved, 35
  - framework, 10
    - bar framework, 10
    - bar-and-body, 153
    - bodies, 153
    - definition, 9
    - degrees of freedom, 156
    - flexible, 12
    - generic bar-and-body, 153
    - infinitesimal mechanism, 13
    - isostatic, 156
    - node, 9
  - general position, 102
  - generic, 15, 135
    - d*-rigid, 138
    - bar-and-body, 153
    - dense, 136
    - pure condition, 135
    - rigidity, 137
  - graph
    - independent, 145
    - Laman graph, 175
    - union, 140
    - vertex degree, 140
  - graphical statics, 37
  - group, 188
    - abelian, 189
    - acting freely, 234
    - acting transitively, 235
    - action, 198
    - acts, 234
    - alternating, 191
    - automorphism, 256
      - inner, 256
      - outer, 256
    - commutative, 189
    - commute, 189
    - conjugacy classes, 197
    - conjugate, 196
    - cyclic, 191
    - dihedral, 191
    - direct product, 240
    - element order, 189
    - homomorphism, 193
      - kernel, 193
    - identity, 194
    - inverse, 189
    - inversion, 194, 250
    - isomorphism, 193
  - matrix, 192
  - normal subgroup, 256
  - order, 189
  - permutation, 190
  - presentation, 241
  - product, 189
  - relations, 241
  - self-conjugate subgroup, 256
  - simple, 248
  - subgroup, 189
  - symmetric, 190
  - symmetry, 189
  - words, 241
- Henneberg
  - type I construction, 26
  - type II construction, 26
- incidence preserving, 61
- infinitesimal
  - displacement, 17, 19
  - expanding, 171
  - extension, 18
  - external work done, 28
  - first-order motion, 122
  - flex, 12, 17, 21
  - internal mechanism, 24
  - internal work done, 28
  - mechanism, 21
  - motion, 12
  - rigid-body displacement, 21
  - rigid-body rotation, 24
  - rigidity, 25
  - rotation, 19
  - strictly expanding, 171
  - trivial first-order motion, 122
- infinitesimal motions
  - trivial, 13
- initial position, 11, 17
- internal
  - forces, 28
  - vector space, 205
  - work, 205
- inversion, 177
- irreducible submodule, 229
- isomorphic  $\mathbb{R}\mathcal{G}$ -modules, 221
- isostatic, 26, 35
- kinematically
  - determinate, 25
  - indeterminate, 25
  - overdetermined, 26
- kinematically determinant, 13
- Laman, 140
- length preserving direction, 98
- lifted surface, 40

- matrix  
 augmented configuration, 89  
 cokernel, 25  
 compatibility, 19  
 configuration, 89  
 Hessian, 113  
 kernel, 21, 193  
 Kronecker product, 87  
 positive semi-definite, 88  
 quadratic form, 113  
 skew symmetric, 13, 21  
 trace, 196
- Maxwell diagram, 37
- mechanism  
 finite, 11  
 infinitesimal mechanism (framework), 13  
 linkage, 177
- member, 9  
 bar, 10  
 direction, 98
- minimal  $d$ -cycle, 147
- Molecular Conjecture, 153
- motion, 11  
 differentiable, 12
- node  
 edge, 173
- north pole, 161
- nullity, 24
- nullspace, 21, 25  
 left-nullspace, 25
- orbit, 235
- oriented, 38
- orthogonal  $\mathbb{R}\mathcal{G}$ -modules, 221
- packing, 73  
 jammed, 73
- parallel redrawing, 182
- pebble game, 143
- permutation  
 even, 191, 240  
 odd, 191, 240  
 transposition, 240
- permutation matrix, 193
- points at infinity, 93
- Pollaczek-Geiringer, 140
- polygon  
 external angle, 173  
 pointed pseudo-triangle, 173  
 pseudo-triangle, 173
- polytope  
 cross-polytope, 181  
 sides, 52  
 vertex, 49
- potential function, 81
- prestress stable, 114
- prestressably stable, 115
- proper self-stress, 66  
 proper stress, 66
- quadratic form, 113, 119  
 Hessian, 113  
 zero set, 119
- quadric surface, 59
- reciprocal diagram, 37
- reciprocal figures, 37
- redundant, 26
- representation, 195  
 character, 196  
 character table, 201  
 faithful, 201
- complex, 195
- dimension, 195
- equivalent, 195
- irreducible, 196
- left regular, 198
- real, 195
- reducible, 196
- right regular, 199
- trivial, 197
- rigid  
 infinitesimal, 13
- rigid-body  
 displacement, 11  
 motion, 11  
 rotation, 11
- rigidifying self-stress, 84
- rigidity  
 $d$ -rigid, 138  
 certificate for global rigidity, 148  
 dimensional, 132  
 generic, 137  
 global, 15  
 infinitesimal, 12  
 isostatic, 26  
 just rigid, 26  
 map, 18  
 matrix, 20  
 redundant, 152  
 second-order, 122  
 static, 15  
 statically rigid, 66  
 universal, 16, 95, 149
- self-stress, 33, 82  
 proper, 66  
 rigidifying, 84
- semi-algebraic set, 64, 176
- simple truss, 26
- simplex, 95
- Singular Value Decomposition, 209
- slender adornments, 181
- south poie, 161

- spider web, 85
  - graph, 85
- static
  - equilibrium, 27
  - isostatic, 35
  - statically determinant, 34
  - statically indeterminant, 34
  - statically overdetermined, 35
  - statically rigid, 35
- statics
  - graphical, 37
- stiffness, 41
  - positive axial stiffness, 41
- stiffness matrix
  - tangent, 113
  - total, 114
- strain energy, 78
- stress, 13, 29
  - determinant, 238
  - force density, 14
  - local stress matrix, 237
  - matrix, 87
  - proper, 66, 82
  - rigidifying self-, 84
  - self-stress, 33, 82
- stress matrix
  - large, 88, 114
- strut, 62
- support plane, 49
- suspension, 161
- SVD, 209
- symmetric, 188
- symmetry, 187
  - operation, 187
- tensegrity, 62
  - ( $a, b$ )-tensegrity, 97
  - bar, 62
  - cable, 62
  - Cauchy polygon, 102
  - constraints, 64
- finite mechanism, 64
- first-order motion, 122
- infinitesimally rigid, 65
- kinematic conditions, 64
- rigid, 64
- second-order motion, 122
- second-order rigid, 122
- static conditions, 66
- strict motion(first- and second-order), 128
- structure, 62
- strut, 62
- super stable, 101
- trivial first-order motion, 122
- trivial second-order motion, 122
- unyielding, 91
- tensor product
- spaces, 202
- vectors, 202
- transformation
  - projective, 55
  - transformed to infinity, 55
- transformation matrix, 192, 210
- transformation operator, 209
- transitivity class, 235
- triangle-chain framework, 133
- trivial, 23
- vector field, 172
- vector space
  - external, 205
  - internal, 205
- vertex
  - ( $d + 1$ )-connected, 152
- vertex splitting, 146
- virtual work, 30
- winner, 251
- work
  - external, 205
  - internal, 205
- work conjugate, 28