

7 Index

A

Acetylene, 100
 Acoustics of a concert hall, 142
 Acrylic glass, 137, 138, 139, 142, 159
 Adiabatic compression, 5, 6
 Agitated vessel, 169, 171, 178, 184, 186
 heat transfer, 169, 174
 power consumption, 169
 power demand, 171, 174
 suspending particulate matter, 176, 177, 182, 186
 Agitator, 172, 174, 175, 183
 Apollo Program, 146
 Area momentum, 63, 156, 157, 158, 160
 Astronomical system of units, 25
 Atomic reactor, 109

B

Basic quantities, 38
 Basic units, 20
 Beam, steel, 139, 156
 Beds of solid particles, 85
 Bernoulli's equation, 9
 Bubbles
 terminal velocity
 air in water, 15
 in champagne, 84
 in liquid iron, 125, 129
 in liquids, 130
 Buckingham Theorem, 43, 51
 exception, 51, 139
 Bueche's Theorem, 187

C

Calculation procedure
 after Pawlowski, 42, 51
 examples, 48
 Celsius temperature, 17
 Centrifugal pump, 63, 64, 120, 122
 low viscous liquids, 124
 specific speed, 63
 Chloroform, 146
 Climate Orbiter, 26
 Coherent units, 7, 10
 Concert hall, 142

Converter, steel refining, 125

D

Dam, 131
 Degree of freedom, 98
 Degrees
 Celsius, 17
 Kelvin, 17
 Dependent quantities, 99
 Derivation, 35
 Derivation of dimensionless numbers
 different sets, 51
 from algebraic equations, 32
 from differential equations, 34
 from relevance lists, 37
 modified sets, 66
 short sets, 55
 Dimensional analysis, 43
 Dimensional matrix, 39, 42
 rank, 98, 99
 Dimensionless groups, 27, 69
 number of equivalent sets, 69
 smallest, 28, 69
 Dimensionless numbers, 27, 28
 calculation procedure, 38, 42
 check of equivalence, 70
 complete sets
 number, 43
 derivation of different sets, 51
 derivation of sets
 from algebraic equations, 32, 33
 from differential equations, 34, 36
 from given set, 66
 from relevance lists, 37, 42
 derivation of short sets, 55
 for the investigation of natural phenomena, 74
 generation from known dimensionless numbers, 68
 listing, 29
 physical interpretation, 77
 short sets, 55
 structure, 27
 Dimensionless products, 27
 Dimensionless quantities,
 complete sets, 43

Distortion of a spring, 51
 Drag on a ship, 113, 114, 196, 197
 Droplets, 15

E

Earthquake, 131
 Earthquakes
 resistance of a dam, 131, 132
 Elastic modulus, 131, 135, 139, 156
 Empirical relationships, 84
 Equivalence transformations, 44
 applied to columns, 44
 applied to rows, 44
 Euclid, 3

F

Fast-breeder, 109
 Fixed bed, 91
 Fluidized bed, 86, 184
 heterogeneous, 90
 homogeneous, 87, 90
 Free quantities, 99, 153
 number of, 152
 restrictions, 153
 Froth height, 19
 Froude, William, 113, 199
 Froude's hypothesis, 199

G

Gaussian elimination, 44
 Glass, 193
 Glassware, 188
 Glycerine, 116, 129

H

Heat capacity, 63
 Heat transfer, 169
 convective, 35
 flat plate, 47, 49, 60, 61
 liquid sodium, 109, 110
 sulfuric acid, 108, 165, 166
 Heat transfer coefficient, 62
 Homogeneous functions, 6, 8, 43
 Hook's law, 139

I

Impeller
 power consumption, 185

Inscription of scientific diagrams, 14
 International System of Units, 24
 Invariance, 6, 7
 principle, 6

K

Kaskas equation, 33, 89
 Kelvin temperature, 17

L

Liquid iron, 125
 Liquid level before a weir, 11, 12, 14
 Liquid Nitrogen, 116
 Liquid Oxygen, 117, 118
 Liquid Sodium, 104, 109
 Lunar Excursion Module, 146, 147
 landing stability, 146, 148

M

Mars, 26
 Mass momentum of inertia, 41, 65
 Mathematical pendulum, 39
 Matrix
 columns, 38
 core, 44
 equivalence transformations, 43
 rank, 39
 residual, 39, 99
 rows, 38, 44
 unity, 39, 42
 Matrix, dimensional, 42
 core, 73
 equivalence transformations, 43
 rank, 43
 residual, 44
 standard form, 44
 Mayer, Robert, 2
 Mercury, 112, 135
 Model beam
 acrylic glass, 159
 Model laws, 100
 exploitation of partial functions, 155
 partial investigation, 155
 partial similarity, 153
 restriction to special cases, 154
 Modified quantity equations, 10

N

Newton, 2

second law, 2
 third law, 24
 Numerical equations, 4, 5, 13
 conversion, 16, 18, 19
 examples, 4

O

Oscillations of a building, 135, 136
 Oxygen, 118, 119, 125

P

Pendulum
 mathematical, 41
 physical, 41
 Permutation, 71
 Physical pendulum, 40
 Physical phenomena
 description of, 1
 Physical quantities, 1, 2
 Physical relationships, 8
 formulation of, 3
 Ping-pong ball, 82
 Plate spring
 distortion, 50
 Porosity term, 91
 Pressure drop
 fixed bed, 91, 92, 93
 liquid sodium in a pipe, 104, 105
 smooth pipe, 46, 54, 56
 Production of glassware, 188
 Pump, 120

Q

Quantities, 1, 2, 3
 dependent, 99
 free, 99
 independent, 98
 of different dimensions, 2
 of same dimensions, 2
 reference, 3
 Quantity equations, 10

R

Reference quantities, 7
 Relationships
 described by algebraic equations, 74
 described by differential equations, 79
 Relevance list, 37
 Residual matrix, 39

Resistance
 friction, 199
 wave, 199
 Reverberation time, 146

S

Scientific diagrams, 14
 Ship models, 200, 201
 Similarity, 97
 chemical reactions, 97
 conditions, 98
 definition, 97
 figures, 97
 flows, 97
 geometrical, 97, 160
 heat transfer, 97
 in engineering science, 95
 laws, 98
 partial, 152
 problems, 152
 dependent quantities, 153
 free quantities, 153
 number of the free quantities, 152
 relevance list, 152
 total, 95, 100
 Smallest dimensionless group, 28
 Sodium, 104, 109
 Solid rocket booster, 160, 162
 Space shuttle, 160
 Splashdown, 160
 Spraying, 117
 Spring, 51
 Steel beam, 159
 deformation, 139, 140, 157
 Steel refining, 125, 126
 Stiffness, 63, 156
 Structural matrix, 67
 Sulfuric acid, 108, 165, 166
 Suspending particulate matter, 176, 186
 System of units, 20

T

Terminal velocity, 15, 53, 58
 gas bubbles in liquid, 130
 glass body in acetylene, 100, 101
 oxygen bubbles in liquid iron, 130
 particle, 72
 solid spheres in air, 15
 solid spheres in water, 15

- spherical particle, 33, 45, 52, 57, 77
 - all graphs, 77
 - swarm of particles, 88, 90
 - water droplets in air, 15
- Terminal velocity of a particle, 95
- Terminal velocity of a swarm of particles, 90
- Terminal velocity of bubbles
 - in liquid iron, 129
- Thermal conductivity, 63
- Thermal diffusivity, 192
- Tube reactor, 36
- Typical velocity
 - gases, 17

U

- Unit check, 1, 9, 26
- Units, 7, 20
 - basic, 20

- coherent, 7, 13
- dependent, 20, 21
- independent, 20, 21
- International System, 20, 21
- power product, 7
- systems, 20
 - astronomical, 24, 25
- Unity matrix, 39, 42

V

- Vapor pressure
 - ethanol, 4, 18
- Velocity of a particle
 - function of falling height, 80, 83, 84
- Viscosity
 - glass, 189, 191

W

- Wood's alloy, 112