Appendix

Symbols

Lower case letters

a	Acceleration; parameter to be estimated
$\hat{a}$	Identified parameter
$\overline{a}$	Local acceleration
a_{pe}	Angle of accelerator pedal
a_i	Polynomial coefficient
a_{ig}	Ignition advance angle
b	Damping coefficient, generator voltage constant
b_i	Polynomial coefficients
c_W	Drag coefficient
e_k	Error signal at time k
f	Function
g	Gravity
h	Increment
h_i	Form function i
$i_{ij,L}$, $i_{ij,C}$	Inductive and capacitive component of current between the nodes i, j
k	Spring constant
k_{ij}	Entry i, j of the stiffness matrix
m	Mass
m_{fuel}	Fuel mass
m_{tv}	Air mass via the throttle valve
m_{ij}	Entry i, j of the mass matrix
m_{air}	Air mass
m_{idle}	Air mass via the idle setting
n	Number of measurements
n_k	Interference signal
n_{cs}	Rotation speed of crankshaft
p	Pressure
p_{el}	Electrostatic pressure
p_{i0}, p_{i1}	Load at the nodes 0 and 1

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p_m	Average pressure in the cylinder
Q	Charge
q_i	Value of a boundary condition; generalised coordinate
r	Rotational degree of freedom; exciting function; radial local variable
s	Natural coordinate
s_i	s-coordinate of a Gauss–Legendre integration point
t	Time; natural coordinate
t_c	Thickness of cavity
t_i	Thickness of the insulator
t_j	t-coordinate of a Gauss–Legendre integration point
t_{cs}	Trigger signal at crankshaft
t_p	Plate thickness
u	Voltage; deflection
u_i	Node displacement in x-direction
u_{ij}	Voltage between the nodes i, j
v	Velocity; deflection
$\overline{v}$	Local velocity
v_i	Node displacement in y-direction
w	Excitation
x	Variable; global coordinate
x_k	Input signal at time k
y	Global coordinate
y_k	Output signal at time k
y_k	Output signal of the identified model at time k
z_k	Measured response signal

Upper case letters

A	Area
B_i	Boundary condition i; flexural strength of element i
C	Capacitance
C_i	Constant i
C_{ij}	Capacitance between the nodes i, j; entry i, j of the capacitance matrix
D	Flexural strength; range of a partial differential equation
E	Modulus of elasticity
F	Force; Property of a circuit
I	Moment of inertia
I, i	Current
J	Moment of inertia
L	Inductance, differential operator
L_{ij}	Inductance between the nodes i, j; entry i, j of the inductance matrix
M	Torque

P	Power; parameter
Q	Quality function
Q_i^I	Generalised inertial force
R	Resistance; residuum; radius
S	Sensitivity
T	Energy
U	Voltage
V_D	Piston-swept volume

Greek letters

α	Ratio at a transmission element; angle of road gradient
α_{ij}	Weighting factor for the Gauss–Legendre integration
$\gamma_{xy}, \gamma_{xz}, \gamma_{yz}$	Shear strains
Δ	Laplace operator
ε_0	Dielectric constant
$\varepsilon_{r,eff}$	Effective, relative dielectric constant
$\varepsilon_{xx}, \varepsilon_{yy}, \varepsilon_{zz}$	Strains
ζ	Variable for the approximation of continuous displacements
η	Efficiency
λ	Fuel mixture ratio
μ_i	Mass occupancy of element i
ν	Poisson's ratio
Π	Elastic potential
ρ	Density
$\tau_{xx}, \tau_{yy}, \tau_{zz}, \tau_{xy}, \tau_{xz}, \tau_{yz}$	Stresses
ϕ	Solution of a partial differential equation
ϕ_i	Potential at node i
ψ	Magnetic flux
ω	Angular velocity

Vectors / matrices

$\mathbf{a}$	Acceleration matrix
$\mathbf{B}$	Damping matrix
$\mathbf{C}$	Capacitance matrix; material matrix
$\mathbf{F}$	Force vector
$\mathbf{H}$	Interpolation matrix
$\mathbf{I}$	Inertia tensor
$\mathbf{J}$	Jacobi operator
$\overline{\mathbf{J}}$	Global Jacobi matrix
$\mathbf{k}$	Vector of the generalised, gyroscopic forces
$\mathbf{K}$	Stiffness matrix
$\mathbf{L}$	Inductance matrix

$\mathbf{M}$	Mass matrix; torque vector
$\overline{\mathbf{M}}$	Block diagonal matrix of mass and inertia tensors
$\overline{\mathbf{p}}^{e}$, $\overline{\mathbf{p}}^{r}$	Applied force/moment vector, reactive force/moment vector
$\mathbf{p}_i$	Load vector at element I
$\hat{\mathbf{u}}$	Vector of node displacement, element displacement vector
$\boldsymbol{\varepsilon}$	Vector of the element strains
$\boldsymbol{\tau}$	Vector of the element stresses
$\boldsymbol{\omega}$	Rotating velocity vector

Abbreviations

AMS	Analogue mixed-signal
DAE	Differential-algebraic equation system
DSP	Digital signal processor
IEEE	Institute of electrical and electronics engineers
FPGA	Field programmable gate array
HDL	Hardware description language
RAM	Random access memory
SCS	Society of computer simulation
VHDL	VHSIC hardware description language
VHSIC	Very high speed integrated circuit

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