Symbols and abbreviations

a	Height of a cross-section [mm]
a_1	Spacing, parallel to grain, of fasteners within one row [mm]
a_2	Spacing, perpendicular to grain, between rows of fasteners [mm]
$a_{3,c}$	Distance between fastener and unloaded end [mm]
$a_{3,t}$	Distance between fastener and loaded end [mm]
$a_{4,c}$	Distance between fastener and unloaded edge [mm]
$a_{4,t}$	Distance between fastener and loaded edge [mm]
A_i	Cross-section of member i [mm^2]
A_i^*	Effective cross-section of member i [mm^2]
b	Width of a cross-section [mm]
C	Crossover probability
$ct_{dowel+steel}$	Materials and labour costs per fastener for handling, assembling, drilling, and bolting, including the adjoining steel plates [€ dowel^{-1}]
ct_{GL}	Price of the manufactured and embedded timber per m^3 [€ m^{-3}]
d	Fastener diameter [mm]
E	Elitism percentage to apply
E_{mean}	Mean value of the elastic modulus [N mm^{-2}]
$E_{0.05}$	Fifth percentile of the elastic modulus [N mm^{-2}]
$F_{ax,Rk}$	Characteristic axial withdrawal capacity of the fastener [N]
$f_{c,0,d}$	Design compressive strength along the grain [N mm^{-2}]
$f_{c,0,k}$	Characteristic compressive strength [N mm^{-2}]
F_d	Calculated load at a joint for a row of fasteners [N]
$f_{h,1,k}$	Characteristic embedment strengths in the timber members [N mm^{-2}]
$f_{m,k}$	Characteristic bending strength [N mm^{-2}]
$f_{m,y,d}$	Design bending strength about the principal y-axis [N mm^{-2}]
$f_{m,z,d}$	Design bending strength about the principal z-axis [N mm^{-2}]
$f_{t,0,d}$	Design tensile strength along the grain [N mm^{-2}]
$f_{t,0,k}$	Characteristic tensile strength [N mm^{-2}]
$f_{u,k}$	Characteristic tensile strength of bolts [N mm^{-2}]
$F_{v,Ed}$	Design shear force on the connection [N]
$F_{v,ef,Rd}$	Effective design load-carrying capacity of one row of fasteners parallel to the grain [N]
$F_{v,ef,Rk}$	Effective characteristic load-carrying capacity of one row of fasteners parallel to the grain [N]
$f_{v,k}$	Characteristic shear strength [N mm^{-2}]
$F_{v,Rk}$	Characteristic load-carrying capacity per shear plane per dowel [N]
$F(x)$	Modified objective function [€]
$f(x)$	Objective function [€]
$F_{90,Rd}$	Design splitting capacity [N]
$F_{90,Rk}$	Characteristic splitting capacity [N]
$G_j(x)$	Maximum ultimate limit state utilisation ratio in each bar j
h	Edge depth (i.e., height at the truss supports) [m]
H	Greatest depth of the truss (i.e., midpoint height) [m]
j	Number of variables studied
$k_{c,y}$ or $k_{c,z}$	Instability factor for the y- or z-axes
k_m	Factor considering redistribution of bending stresses in a cross-section
k_{mod}	Modification factor, which takes into account the effect of the duration of the load and the moisture content
K_{ser}	Slip modulus
K_u	Instantaneous slip modulus for ultimate limit states
L	Span of the truss [m]
l_i	Length of member i [mm]
M_d	Design bending moment [kN m]
$M_{y,Rk}$	Characteristic yield moment of fastener (dowel) [N mm]
n	Number of members of the upper chord
$n_{a,i}$, $n_{e,i}$	Numbers of dowels at the member ends
Nc	Number of individuals who enter to form part of the crossover
N_d	Axial force [kN]
n_{dowel}	Number of dowels within one row
N_{dowels}	Total number of dowels in a truss
Ne	Number of elite individuals in the population in each generation
n_{ef}	Effective number of dowels
Np	Total number of individuals in the population considered
$P_j(G_j(x))$	Penalisation of the objective function in accordance with the ultimate limit state [€]
$S(x)$	Maximum ultimate limit state utilisation ratio
t_1	Timber thickness or penetration depth [mm]
t_s	Steel plate thickness [mm]
$T(S(x))$	Penalisation of the objective function in accordance with the serviceability limit state [€]
V_{GL}	Total volume of glued laminated timber [m^3]
x	Member of the study population
α	Angle between the direction of the force and the fibres
γ_m	Partial safety factor for a material property
ρ_k	Characteristic density [kg m^{-3}]
ρ_m	Mean density [kg m^{-3}]
$\sigma_{c,0,d}$	Design compressive stress along the grain [N mm^{-2}]
$\sigma_{m,y,d}$	Design bending stress about the principal y-axis [N mm^{-2}]
$\sigma_{m,z,d}$	Design bending stress about the principal z-axis [N mm^{-2}]
$\sigma_{t,0,d}$	Design tensile stress along the grain [N mm^{-2}]

Abbreviations

GA	Genetic algorithm
MPCWT	Metal plate connected wood trusses
NLP	Nonlinear programming
SLS	Serviceability limit state
ULS	Ultimate limit state