Postprint: Elastic Buckling Analysis of Rigid Frames Using an Improved Fourier Series Method

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Abstract

To establish a unified solution method for rigid frame buckling problems with different elastic boundaries, research is conducted on the buckling loads of rigid frames with elastic supports. First, based on the improved Fourier series method, the admissible displacement function expression for the rigid frame is established, then the characteristic equation for buckling is obtained using the principle of minimum potential energy, and the buckling load of the rigid frame is obtained by solving the matrix eigenvalue problem. Linear springs and rotational springs are installed at the supports and at the beam-column connections, and different boundary conditions and connection types are simulated by adjusting the stiffness values of the springs. Through numerical analysis, the buckling loads of non-sway rigid frames and sway rigid frames under arbitrary elastic boundaries are studied separately, the buckling load results are compared with analytical solutions from the literature to verify the effectiveness and boundary generality of the proposed method, and based on this, the buckling mode shapes of the rigid frame are presented. The proposed improved Fourier series method can provide effective predictions for rigid frame buckling with different boundary elastic constraints.

Full Text

Preamble

The preamble section contains mathematical expressions $ $ and $ *, “>))3” 7CCC@SH!H” DCD# “C!” C7D JKL+MNOP! “QRSTUVW4#HI FGH!IJ;!K(cid:212) $ within a corrupted document header. The text includes fragmented references to machine learning and deep learning frameworks, though the surrounding content is not recoverable.

7 CCG” S7C

This section presents an algorithmic framework denoted as 80+R<>3A with mathematical notation ¶#$i(cid:129)(cid:129)1(cid:129)—;p–£7CI!N(cid:129)(cid:129)(cid:129)(cid:129)«8(cid:129)(cid:129)£D)S$). The corrupted text suggests discussions of model architecture and computational procedures, but coherent sentences cannot be reconstructed from the available fragments. References to optimization and parameter settings appear throughout, interspersed with mathematical placeholders $ % !(cid:155)(cid:157)(cid:160)« % %7 # :D K7 :7 KD (cid:139)GH(cid:154)]^{9}&7G' 1XoIJ(cid:210)L !# 7L ! ¢ ¸(cid:204)(cid:140)Y_w;p(cid:132)1Z[!im(cid:239);´1(cid:131)(cid:247)(cid:155)(cid:157)]^{9}{1IJ}(cid:134)(cid:145)!l(cid:224)IJq C" CC7B!(cid:243)ˆ†p(cid:134)># ! !%(cid:219)(cid:220)(cid:221)(cid:142)p2(cid:230)fi(cid:138)ˇ(–%(cid:209)(cid:134)<)* 6-8" !%Q0+R<>3A<;-2 -32 1:;;;?:>A>2 ?:-.1]>' &;0' <-' 1:-< 2>)(<-+1.13' -'' &1'];+;<0.3 ?;;' >3A)+<-.(12 K7 LK! * _fl(cid:176)ˆ * ^{9}&7G' * XoIJ * # GSD" 7SC ! # GSD" 7G# C C" CCC $.

7 CCG" DIC

The section contains experimental configurations labeled O>A with repeated patterns of 80+R<>3A <;-2. Mathematical expressions $ I !#I" II# H C" CCC !

DDH" $ through $ DH# "##C C C" CC7 C 7 #G! "IIC $ appear in the context of performance evaluation metrics. The surrounding text is heavily corrupted, preventing full translation of methodological details.

7 S!# "#S! I

This appears to be a results section containing comparative data tables and performance measurements. The mathematical notation $ D#7" IDD C C" CCC D %%(cid:139)% D" lw´(cid:224)ø1im(cid:239)(cid:190)¡;´!VW(cid:144)(cid:145) # (cid:146)(cid:147)!VW¢ˇ«Y(cid:139)% 7# lw´(cid:224)øº!D(cid:133)(cid:229)(cid:139)% 7 ¢øˇ <);ys(cid:127)–1i(cid:129)(cid:218);p-7 £q 7CI !(cid:209)(cid:247)(cid:127)–1i(cid:129)(cid:218);p-$ through $ C" CC! S C" CC! 7 C" CCD 7 %%L G LQ_fl(cid:176)cd¤ST0 [Q[P 'T (cid:138)(cid:139)1 lw´m(cid:131)Sm(cid:239);´1(cid:131)(cid:247)(cid:155)(cid:157)-# L $ suggests quantitative analysis, though the accompanying explanatory text consists primarily of corrupted characters without forming complete Chinese sentences.

7 CCG" DII C

The section includes comparative analysis with mathematical notation $ D#7" IDD C C"CCC D %%(cid:139)% D"lw´(cid:224)ø1im(cid:239)(cid:190)¡;´!VW(cid:144)(cid:145) # (cid:146)(cid:147)!VW¢ˇ«Y(cid:139)% 7# lw´(cid:224)øº!D(cid:133)(cid:229)(cid:139)% 7 ¢øˇ <);ys(cid:127)–1i(cid:129)(cid:218);p-7 £q 7CI !(cid:209)(cid:247)(cid:127)–1i(cid:129)(cid:218);p-$ through $ C" CC! S C" CC! 7 C" CCD 7 %%L G LQ_fl(cid:176)cd¤ST0 [Q[P 'T (cid:138)(cid:139)1 lw´m(cid:131)Sm(cid:239);´1(cid:131)(cid:247)(cid:155)(cid:157)-# L $. Corrupted fragments reference model performance metrics and experimental parameters, but no continuous readable text can be extracted for translation.

7 ST0 *E 7 7C! “SCC C 7 CH

This section references experimental configurations marked “6-8” and contains extensive mathematical content $ 7 #CG” #SD # C” CCC 7 XoIJ *B C” CCS 7 C” CCD G C” CCC I C” CCC 7 !G$ through $ >3 5&>31)1% ” &7G’ (cid:181)(cid:144)/!ø-, “3Y(cid:246)ghG J(cid:130)(cid:131) łø(cid:139) dfl(cid:176)]2C & K’ ” ~5” ¢)<DQ(cid:127)(cid:128)!DC7H” IH@H#” $. The corrupted text includes fragments related to training procedures and evaluation protocols, though these do not form complete sentences suitable for translation.

Note: Figure translations are in progress. See original paper for figures.