front page / article / Details 凸

 $\stackrel{\wedge}{\square}$

 \vdots

Selective integration method based on B_BAR technology to calculate t he stiffness matrix of C3D8 unit (Python version)

Yimumu jingle bell 🕤 | 7 months ago | View 7224 + FOCUS ON

The content shared this time is to calculate the stiffness matrix of the C3D8 unit using the selective integration method based on B_BAR technology .

Preface

1. prevent mesh locking

atrix calculation formula in the textbook. The final displacement field result was almost the same as that of Abaqus, but only the stiffness matrix was very different. Check it repeatedly., to confirm the correctness of the program, but the stiffness matrix was different. I was confused at the time, but later found the root cause on the official website of Abaqus. The official explanation is as follows:

In the past self-compiled finite element program, I programmed and solved it according to the C3D8 unit stiffness m

Basically, what are the benefits of using the selectively reduced-integration technique?

Which step was performed in the middle: the strain-displacement relation (β -matrix) is modified.

OK, after knowing the above reasons, I followed the clues, looked up the literature, and found out what it is: the sel

ectively reduced-integration technique, and finally found the relevant introduction in Mr. Hughes's book:

There is also a document on the Internet introducing BBAR technology:

2. provides accurate solutions in incompressible or nearly incompressible cases

Mumu gave you a summary based on the above literature. Again, you don't need to know the calculation princi ple clearly, it will be implemented in the program.

BBAR theory

For the C3D8 unit, the original strain relationship matrix B should be like this:

 $B = [B_{n_1}, \quad B_{n_2}, \quad \dots \quad , \quad B_{n_8}]$

transform the matrix:B

in,

For the B matrix of a certain node:

 $B = B_{dil} + B_{dev}$

OK, that's it for the introduction. If you are interested in the subsequent exciting theoretical content, you can check Mr. Hughes' s book in detail. For the program to calculate the unit stiffness matrix, you only need the above formul

 $B_{dev} = B - B_{dil}$

a. During the integration point cycle, use full integration calculation and reduced integration calculation, that is, 8 Gaussian integration point cycles are performed for , and 1 Gaussian integration point calculation is performed

for $.B_{dev}B^{dil}B_{dev}B^{dil}$

def calElemStiff2(XCoords, nu):

11 11 11

python program

基于B_BAR技术的选择性积分法计算C3D8单元的刚度矩阵 GaussPoints = np.array([[-1, -1, 1], [1, -1, 1], [1, 1, 1], [-1, 1, 1], [-1, -1, -1],[1, -1, -1],[1, 1, -1], [-1, 1, -1]])GaussPoints = 1.0 / np.sqrt(3) * GuassPoints Ke = np.zeros([24, 24], dtype=float) CC = CO(nu)for i in range(8): # the deviatoric part of B 进行全积分计算 xi, eta, zeta = GaussPoints[i] B_Dev, detJ = BMechDev(XCoords, xi, eta, zeta) Ke += np.dot(np.dot(B_Dev.T, CC), B_Dev) * detJ # the dilatational part of B 进行减缩积分计算 xi, eta, zeta = 0.0, 0.0, 0.0 w1 = 8.0B_Dil, detJ = BMechDil(XCoords, xi, eta, zeta) Ke += w1 * np.dot(np.dot(B_Dil.T, CC), B_Dil) * detJ return Ke Finally, the maximum difference between the elements in the Abaqus stiffness matrix is max. difference: 5.8286708 79282072e-16, which is almost consistent!

Source: Yimumuxiangdingdang

Log in to view the full text for free

UG

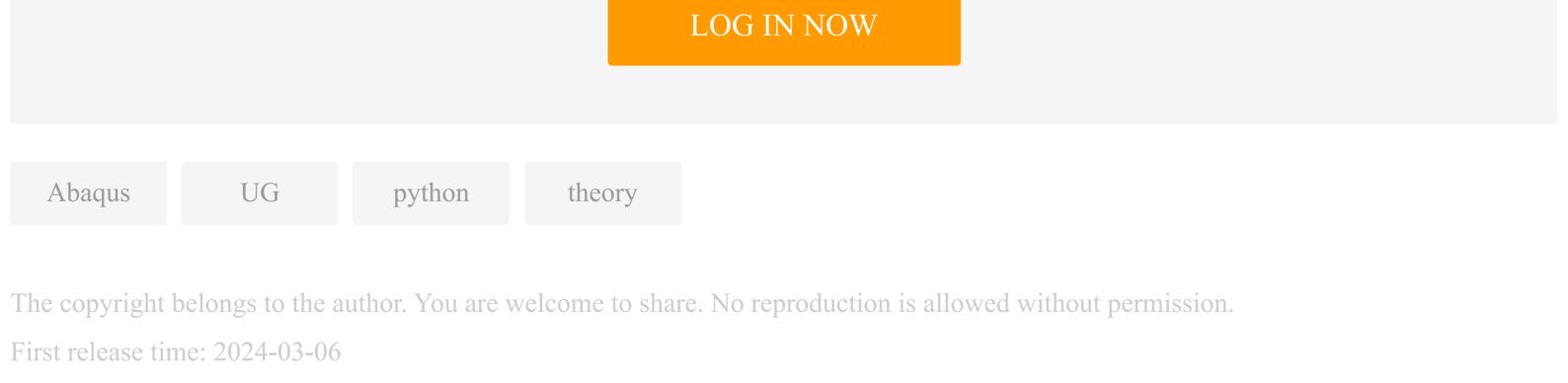
First release time: 2024-03-06

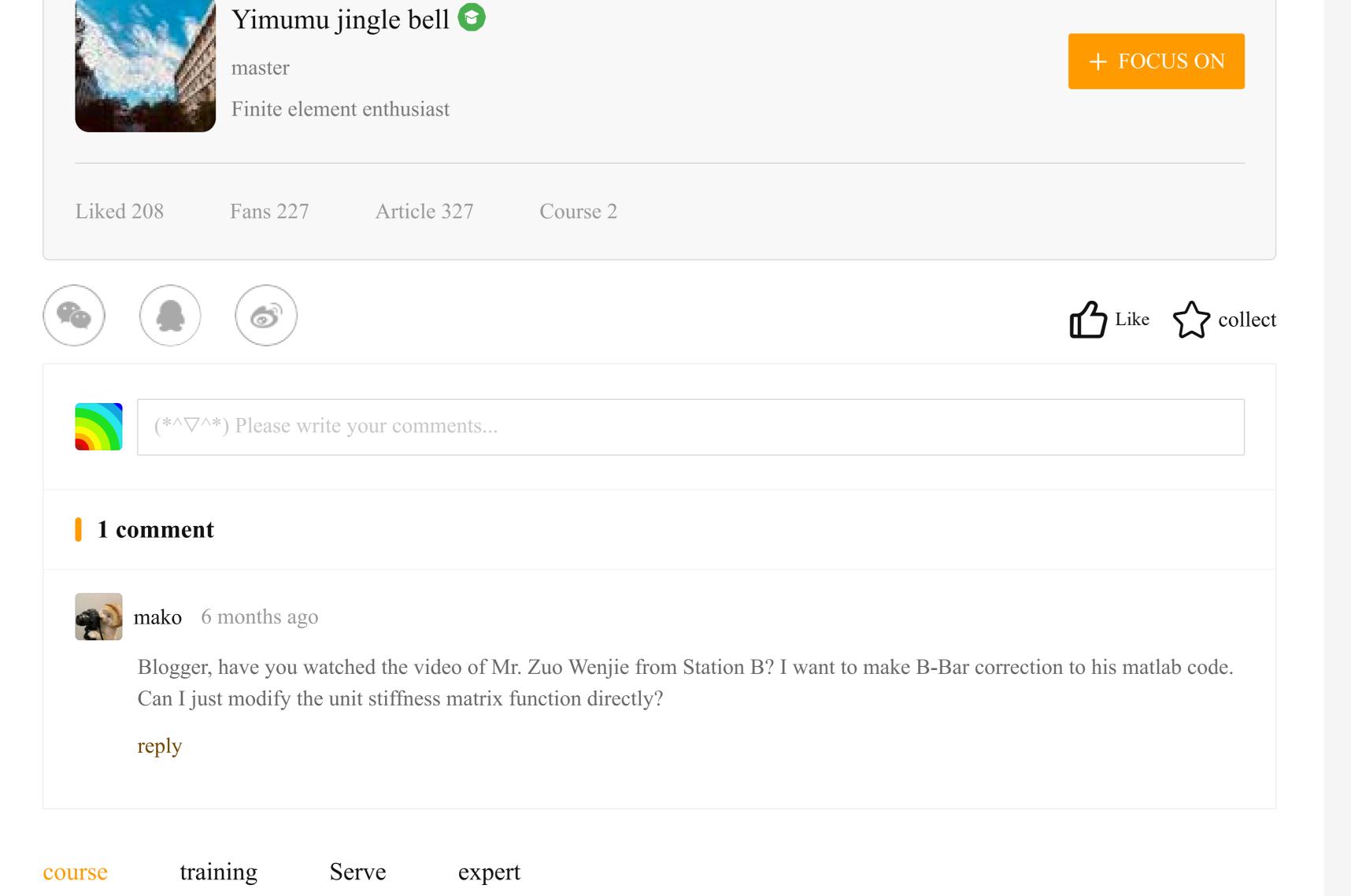
Last edited: 7 months ago

Follow the public account

Join WeChat group

Abaqus





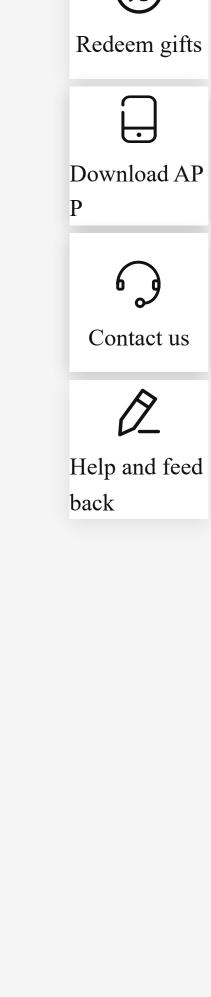
Related recommendations

VIP member =

welfare tasks

兑

Redeem gifts Download AP Contact us





2 ways to define the Cohesive cohesion mo... Abaqus analysis common problems and sol... Detailed explanation of ABAQUS calculati... Electromagnetic field simulation | ChatGPT... **Everyone else is watching** Inventory · Carbon fiber products launched b...

Abaqus analysis common problems and sol...

Several common thermal simulation software 15 open source software that simulation wo... Example of conjugate heat transfer analysis ... Criteria for building digital twin mechanism...

User Agreement About Us Feedback Simulation Knowledge Classroom Simulation Knowledge Service Alliance Chain Name Site Navigation **1** 仿真

Beijing Network Information No. 11010521844260130016 Copyright © 2018-2024 Fu Zhi Gong Chuang. All rights reserved. Please do not reproduce without permission.