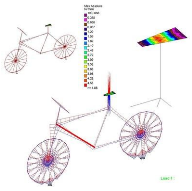
Simple Analysis Of Stress On Pelvic Muscle While Riding A Bicycle

written by Nirmal Raj Joshi | October 4, 2024



Cycling is a popular activity that most of us have experienced at some point in our lives. However, if you've taken a long break from it and then hopped back on the bike, you may have noticed discomfort or even pain in the pelvic region. This is something I encountered after my recent cycling tour, which led me to analyze the stress distribution on the bicycle seat during cycling.

Using STAAD.Pro, I conducted a basic analysis to assess the stress on the bicycle seat. While the analysis was quite rudimentary and didn't account for pretension forces on the spokes, it still provided valuable insights. The analysis showed that the pain is concentrated directly below the seat, where the load is transferred to the bike's frame. With a rider mass of 70 kg (distributed between the seat and the handlebars), the maximum stress observed was around 4 MPa. This level of stress was sufficient to explain the discomfort many of us feel after a long ride!

Here is the code if you want to repeat the analysis.

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STAAD SPACE DXF Import of cycle.dxf START JOB INFORMATION ENGINEER DATE 18-Dec-11 JOB NAME analysis of bicycle ENGINEER NAME nirmal END JOB INFORMATION INPUT WIDTH 79 UNIT METER KN JOINT COORDINATES 1 32.6598 28.8503 0; 2 32.4896 29.2262 0; 3 32.3713 29.1453 0; 4 32.2879 29.0288 0; 5 32.2492 28.8909 0; 6 32.2602 28.748 0; 7 32.3193 28.6175 0; 8 32.4194 28.515 0; 9 32.5486 28.4531 0; 10 32.6912 28.439 0; 11 32.83 28.4745 0; 12 32.9483 28.5554 0; 13 33.0318 28.6719 0; 14 33.0704 28.8098 0; 15 33.0595 28.9527 0; 16 33.0004 29.0832 0; 17 32.9002 29.1856 0; 18 32.771 29.2476 0; 19 32.6284 29.2617 0; 20 34.4598 28.8503 0; 21 34.2896 29.2262 0; 22 34.1713 29.1453 0; 23 34.0879 29.0288 0; 24 34.0492 28.8909 0; 25 34.0602 28.748 0; 26 34.1193 28.6175 0; 27 34.2194 28.515 0; 28 34.3486 28.4531 0; 29 34.4912 28.439 0; 30 34.63 28.4745 0; 31 34.7483 28.5554 0; 32 34.8318 28.6719 0; 33 34.8704 28.8098 0; 34 34.8595 28.9527 0; 35 34.8004 29.0832 0; 36 34.7002 29.1856 0; 37 34.571 29.2476 0; 38 34.4284 29.2617 0; 39 32.8993 29.8509 0; 40 33.5598 28.8503 0; 41 33.8437 29.5157 0; 42 32.8181 29.5116 0; 43 33.8437 29.8 0; 44 32.8993 29.8509 0.3; 45 32.8993 29.8509 -0.3; 46 33.9437 29.8 0; 47 33.7437 29.8 0; 48 33.7437 29.8 0.0201266; 49 33.9437 29.8 0.05; 50 33.7437 29.8 -0.02; 51 33.9437 29.8 -0.05; 52 33.913 29.8 -0.0220038; 53 33.9037 29.8 -0.0439999; 54 33.9037 29.8 0; 55 33.7837 29.8 -0.0259996; 56 33.7837 29.8 0; 57 33.8237 29.8 0; 58 33.9213 29.8 -0.0174479; 59 33.9437 29.8 -0.02; 60 33.9437 29.8 -0.03; 61 33.936 29.8 -0.0375694; 62 33.9216 29.8 -0.0354397; 63 33.9437 29.8 -0.04; 64 33.9265 29.8 -0.00939203; 65 33.8637 29.8 -0.0379998; 66 33.8637 29.8 0; 67 33.8237 29.8 -0.0319997; 68 33.7635 29.8 -0.00723009; 69 33.7761 29.8 -0.0130071; 70 33.7463 29.8 -0.0070937; 71 33.753 29.8 -0.0137868; 72 33.7437 29.8 -0.012; 73 33.7649 29.8 -0.0155657; 74 33.7437 29.8 -0.004; 75 33.9437 29.8 -0.01; 76 33.7437 29.8 -0.016; 77 33.7437 29.8 -0.008; 78 33.9174 29.8 0.0226593; 79 33.9037 29.8 0.0440258; 80 33.7837 29.8 0.0261014; 81 33.8237 29.8 0.0320762; 82 33.9316 29.8 0.0271502; 83 33.9437 29.8 0.02; 84 33.9256 29.8 0.0114676; 85 33.9369 29.8 0.0367192; 86 33.924 29.8 0.0358658; 87 33.8637 29.8 0.038051; 88 33.7466 29.8 0.0132581; 89 33.7437 29.8 0.0161013; 90 33.757 29.8 0.0110781; 91 33.7743 29.8 0.0111249; 92 33.7483 29.8 0.00788722; 93 33.7437 29.8 0.00805063; 94 33.7437 29.8 0.0120759; 95 33.9437 29.8 0.01; 96 33.9437 29.8 0.03; 97 33.7437 29.8 0.00402531; 98 33.9437 29.8 0.04; MEMBER INCIDENCES 1 1 2; 2 1 3; 3 1 4; 4 1 5; 5 1 6; 6 1 7; 7 1 8; 8 1 9; 9 1 10; 10 1 11; 11 1 12; 12 1 13; 13 1 14; 14 1 15; 15 1 16; 16 1 17; 17 1 18; 18 1 19; 19 20 21; 20 20 22; 21 20 23; 22 20 24; 23 20 25; 24 20 26; 25 20 27; 26 20 28; 27 20 29; 28 20 30; 29 20 31; 30 20 32; 31 20 33; 32 20 34; 33 20 35; 34 20 36; 35 20 37; 36 20 38; 37 1 42; 38 40 20; 39 20 41; 40 41 42; 41 40 42; 42 40 41; 43 41 43; 44 39 44; 45 39 45; 46 43 66; 47 43 57; 48 48 80; 49 50 55; 50 51 63; 51 50 76; 52 2 19; 53 19 18; 54 18 17; 55 17 16; 56 16 15; 57 15 14; 58 14 13; 59 13 12; 60 12 11; 61 11 10; 62 10 9; 63 9 8; 64 8 7; 65 7 6; 66 6 5; 67 5 4; 68 4 3; 69 3 2; 70 21 38; 71 38 37; 72 37 36; 73 36 35; 74 35 34; 75 34 33; 76 33 32; 77 32 31; 78 31 30; 79 30 29; 80 29 28; 81 28 27; 82 26 25; 83 27 26; 84 25 24; 85 24 23; 86 23 22; 87 22 21; 90 42 39; 91 53 51; 92 54 46; 94 55 67; 95 56 47; 96 57 56; 98 59 75; 99 60 59; 102 63
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47 97; 188 88 94 89; 189 88 92 94; 191 85 98 96; 192 85 49 98; ELEMENT PROPERTY 93 97 100 101 103 TO
105 107 109 111 TO 113 115 TO 128 130 131 133 - 134 136 137 139 TO 144 146 149 151 TO 155 157 TO 160
162 TO 173 176 - 177 TO 178 180 181 183 184 186 TO 189 191 192 THICKNESS 0.05 DEFINE MATERIAL START
ISOTROPIC STEEL E 2.05e+008 POISSON 0.3 DENSITY 76.8195 ALPHA 1.2e-005 DAMP 0.03 ISOTROPIC CONCRETE E
2.17185e+007 POISSON 0.17 DENSITY 23.5616 ALPHA 1e-005 DAMP 0.05 ISOTROPIC ALUMINUM E 6.89476e+007
POISSON 0.33 DENSITY 26.6018 ALPHA 2.3e-005 DAMP 0.03 END DEFINE MATERIAL MEMBER PROPERTY 37 TO 45 90
PRIS ROUND STA 0.04 END 0.04 THI 0.002 1 TO 36 46 TO 51 91 92 94 TO 96 98 99 102 106 108 110 114 129
132 135 - 138 145 147 148 150 156 161 174 175 179 182 185 190 PRIS YD 0.01 52 TO 87 PRIS YD 0.01 ZD
0.05 CONSTANTS MATERIAL STEEL MEMB 37 TO 45 52 TO 87 90 MATERIAL CONCRETE MEMB 1 TO 36 46 TO 51 91 92
94 TO 96 98 99 102 106 - 108 110 114 129 132 135 138 145 147 148 150 156 161 174 175 179 182 - 185 190
MATERIAL ALUMINUM MEMB 93 97 100 101 103 TO 105 107 109 111 TO 113 - 115 TO 128 130 131 133 134 136
137 139 TO 144 146 149 151 TO 155 157 - 158 TO 160 162 TO 173 176 TO 178 180 181 183 184 186 TO 189
191 192 SUPPORTS 10 29 PINNED LOAD 1 LOADTYPE None TITLE weight SELFWEIGHT Y -1 JOINT LOAD 43 TO 98 FY
-0.07 PERFORM ANALYSIS PRINT ALL FINISH
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