

# Comparing the modal frequency results of a finite element analysis with physical tests on a beam splitter structure with shear plates – 3 T070149-00-K

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RAL June 2007

## Introduction

Previous reports explaining the methodology and earlier work are T070147 and T0707148.

## Modal frequencies from the finite element analysis

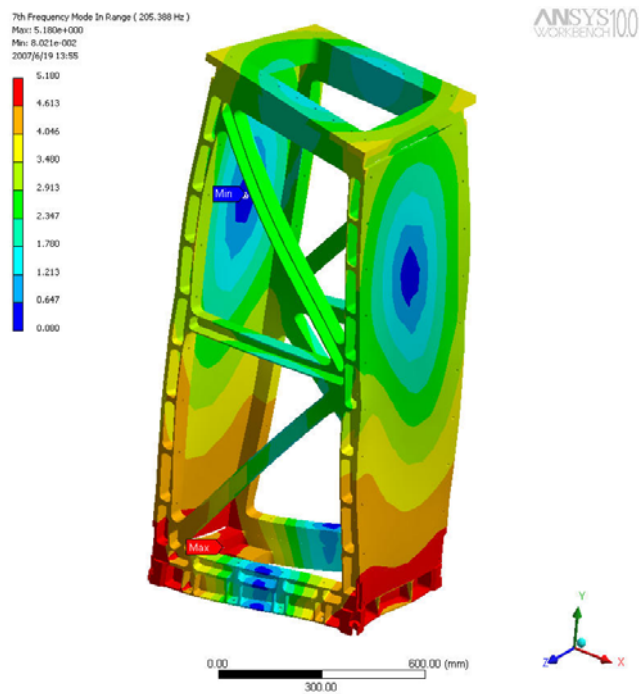


Fig 1. The 7<sup>th</sup> modal frequency at 205Hz

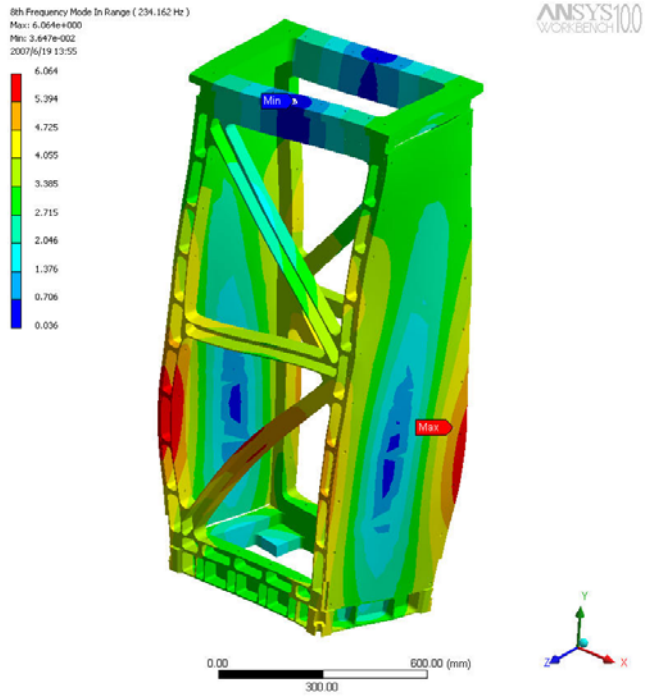


Fig 2. The 8<sup>th</sup> modal frequency at 234Hz

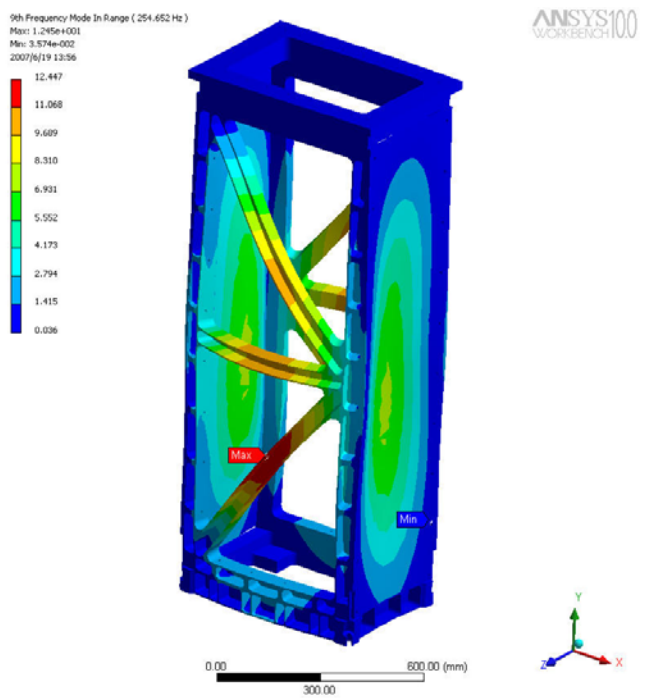


Fig 3. The 9<sup>th</sup> modal frequency at 255Hz

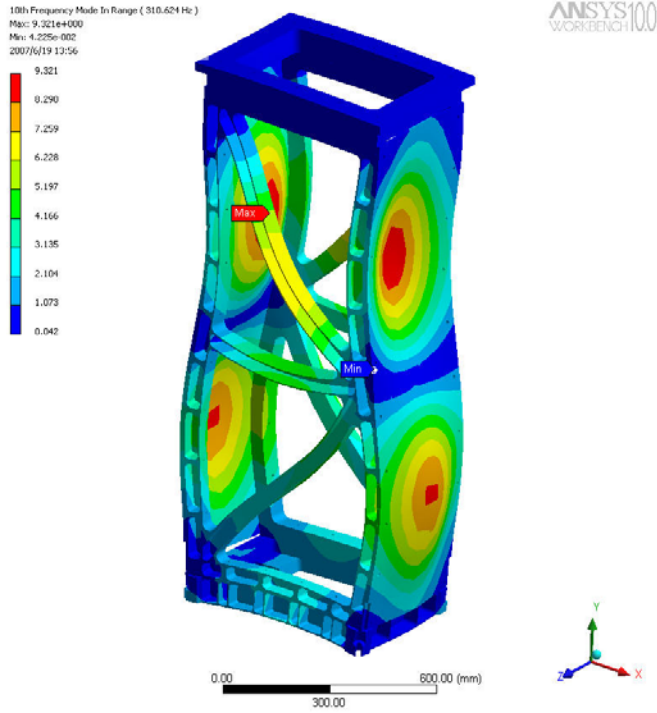


Fig 4. The 10<sup>th</sup> modal frequency at 311Hz

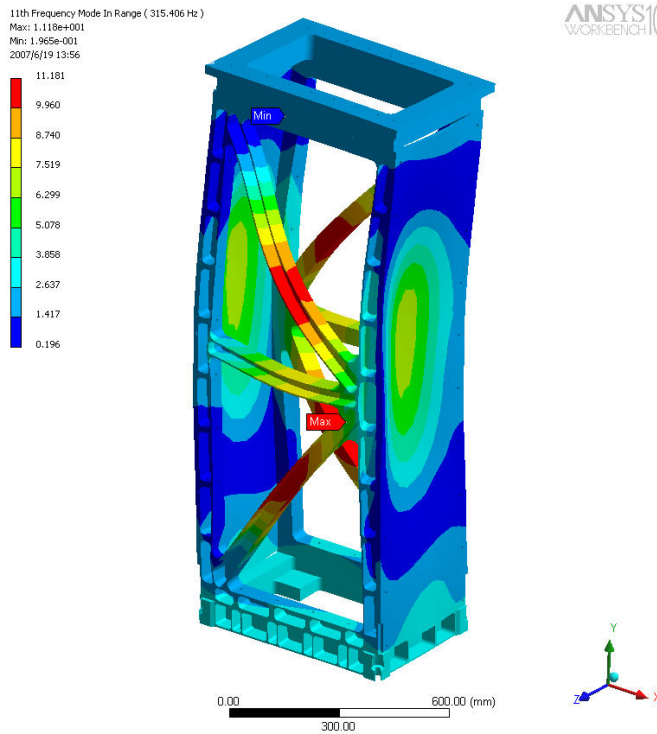


Fig 5. The 11<sup>th</sup> modal frequency at 315Hz



Fig 6. Beam splitter structure with shear plates suspended by a sling.

**Finding the first modal frequency corresponding to the 7<sup>th</sup> FEA modal frequency**



Fig 7. An accelerometer is positioned, in the middle of the bottom ring (top right of picture) representing channel two, and on the right hand side of the ring (bottom right of picture) representing channel one.

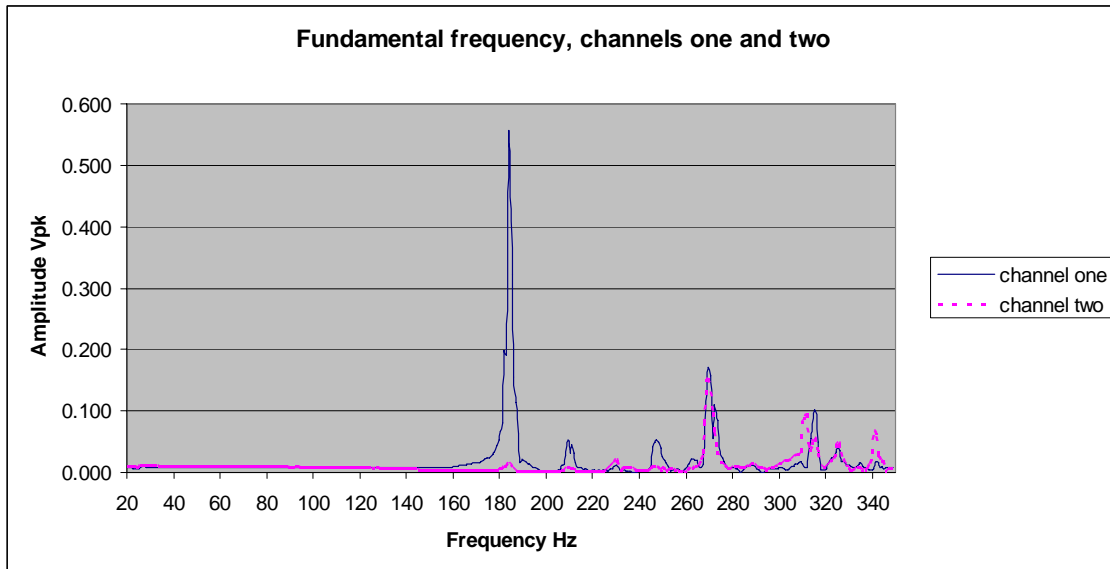


Fig 8. Modal frequencies from the beam splitter structure set up as in figures 6-7

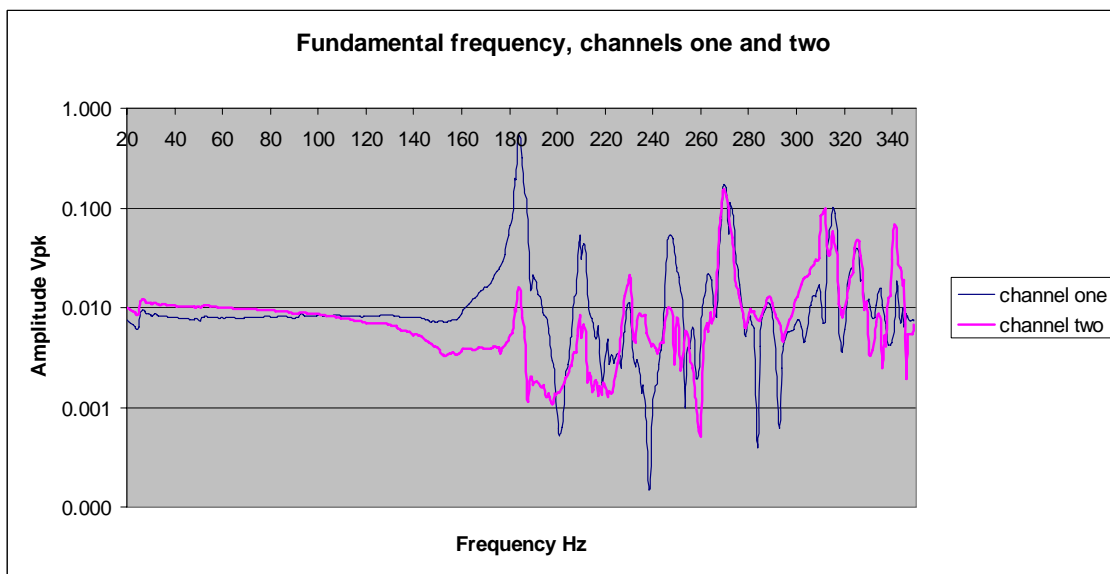


Fig 9. Modal frequencies from the beam splitter structure set up as in figures 6-7 on a logarithmic scale.

Channel one shows the first frequency peak at 185Hz at an amplitude of 0.548Vpk, channel two shows the same peak with an amplitude of 0.016Vpk, this is in character with the 7<sup>th</sup> mode shape shown in figure 1.

**Finding the second modal frequency corresponding to the 8<sup>th</sup> FEA modal frequency**



Fig 10. An accelerometer is positioned, in the middle of the top ring (top of the picture) representing channel two, and on the shear plate (bottom of the picture) representing channel one.

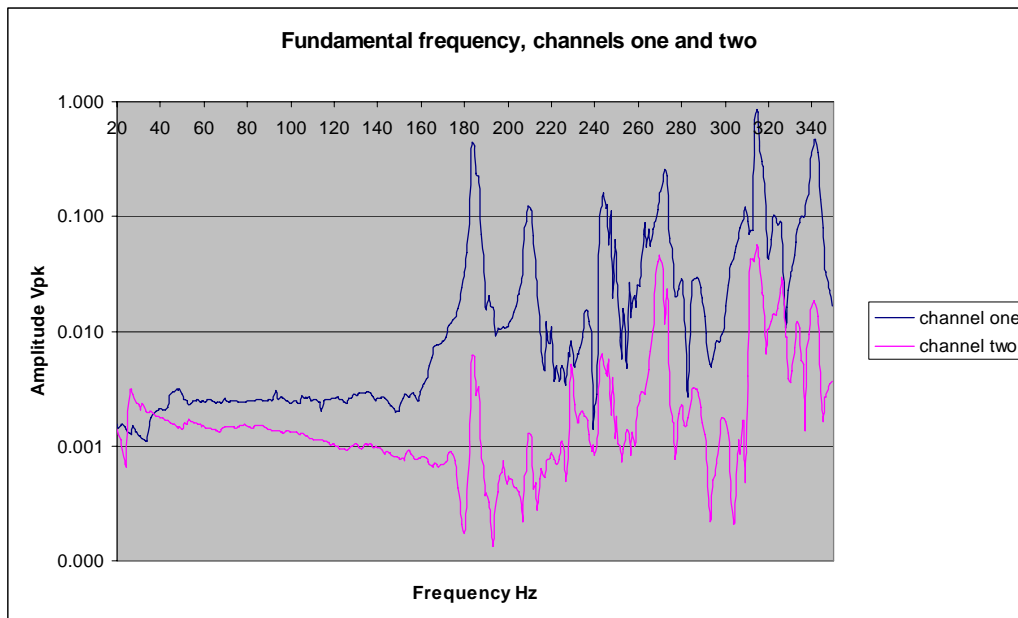


Fig 11. Modal frequencies from the beam splitter structure set up as figure 10.



Fig 12. An accelerometer is positioned, in the middle of the top ring (top of the picture) representing channel two, and on the face plate (bottom of the picture) representing channel one.

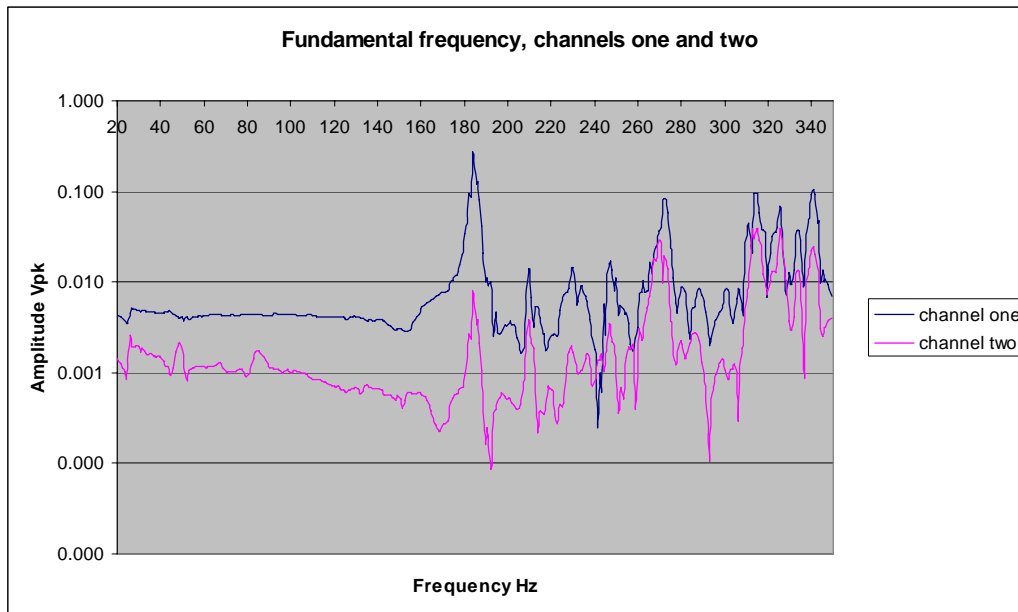


Fig 13. Modal frequencies from the beam splitter structure set up as figure 12.

When the accelerometers are placed as shown in figure 10, the graph in figure 11 shows that there is a 2<sup>nd</sup> modal frequency at 210Hz with an amplitude of 0.125Vpk. When the accelerometers are placed as shown in figure 12, the graph in figure 13 shows that the 2<sup>nd</sup> modal frequency at 210Hz has a diminished by a factor of 10 to an amplitude of 0.013Vpk, this is in character with the 8<sup>th</sup> mode shape shown in figure 2.

## Conclusion

|     | Finite element<br>predicted modal<br>frequency<br>[Hz] | Measured modal<br>frequency<br>[Hz] | Discrepancy<br>[%] |
|-----|--|-------------------------------------|--------------------|
| 1st | 205  | 185                                 | 10                 |
| 2nd | 234  | 210                                 | 10                 |