APPENDIX C - MODAL ANALYSIS OF HINGED-HINGED BEAM

Number of averaged Procedures: 100

The identified natural frequencies, modal damping factors and normal modes are listed in Tables C.1 and C.2.

Table C.1 - Natural Frequencies and modal damping factors for the hinged-hinged beam

<table>
<thead>
<tr>
<th>Natural frequencies</th>
<th>Modal damping factors $x \times 10^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.130</td>
<td>81.206</td>
</tr>
<tr>
<td>57.222</td>
<td>22.496</td>
</tr>
<tr>
<td>129.81</td>
<td>41.237</td>
</tr>
<tr>
<td>216.48</td>
<td>36.900</td>
</tr>
<tr>
<td>342.64</td>
<td>7.6922</td>
</tr>
</tbody>
</table>

Table C.2 – Identified normal modes for the hinged-hinged beam

<table>
<thead>
<tr>
<th>Position</th>
<th>Mode 1 $x \times 10^3$</th>
<th>Mode 2 $x \times 10^3$</th>
<th>Mode 3 $x \times 10^3$</th>
<th>Mode 4 $x \times 10^3$</th>
<th>Mode 5 $x \times 10^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.1956</td>
<td>-2.7045</td>
<td>3.9763</td>
<td>4.7034</td>
<td>-5.4634</td>
</tr>
<tr>
<td>3</td>
<td>2.6710</td>
<td>-4.8463</td>
<td>5.1423</td>
<td>3.0304</td>
<td>-0.4111</td>
</tr>
<tr>
<td>4</td>
<td>4.1645</td>
<td>-5.0361</td>
<td>1.9649</td>
<td>-2.8866</td>
<td>5.2821</td>
</tr>
<tr>
<td>5</td>
<td>5.3259</td>
<td>-3.0588</td>
<td>-2.7845</td>
<td>-4.7733</td>
<td>0.1926</td>
</tr>
<tr>
<td>6</td>
<td>5.1190</td>
<td>-0.0773</td>
<td>-5.1073</td>
<td>-0.1078</td>
<td>-5.1595</td>
</tr>
<tr>
<td>7</td>
<td>4.7935</td>
<td>2.8529</td>
<td>-2.9713</td>
<td>4.7192</td>
<td>0.0530</td>
</tr>
<tr>
<td>8</td>
<td>4.0780</td>
<td>4.8785</td>
<td>1.8480</td>
<td>2.9380</td>
<td>5.1217</td>
</tr>
<tr>
<td>9</td>
<td>3.0438</td>
<td>4.8799</td>
<td>4.9294</td>
<td>-2.9332</td>
<td>-0.2507</td>
</tr>
<tr>
<td>10</td>
<td>1.6110</td>
<td>2.8048</td>
<td>4.0255</td>
<td>-4.6629</td>
<td>-5.2576</td>
</tr>
</tbody>
</table>

The following figures show the measured frequency response function data corresponding to reference position 8 and the reconstructed normal mode model without the contributions of the residual terms.
Position 2

Position 3

Position 4

Position 5

ASSESSMENT OF FREQUENCY DOMAIN FORCE IDENTIFICATION PROCEDURES
Position 6

Position 7

Position 8

Position 9

ASSESSMENT OF FREQUENCY DOMAIN FORCE IDENTIFICATION PROCEDURES
APPENDIX D - MODAL ANALYSIS OF HINGED-HINGED BEAM

Number of averaged Procedures: 200

The identified natural frequencies, modal damping factors and normal modes are listed in Tables D.1 and D.2.

Table D.1 - Natural frequencies and modal damping factors for the hinged-hinged beam with two harmonic force inputs

<table>
<thead>
<tr>
<th>Natural frequencies [Hz]</th>
<th>Modal damping factors x [10^{-4}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.228</td>
<td>148.44</td>
</tr>
<tr>
<td>57.303</td>
<td>42.140</td>
</tr>
<tr>
<td>129.79</td>
<td>44.154</td>
</tr>
<tr>
<td>216.31</td>
<td>56.103</td>
</tr>
<tr>
<td>342.66</td>
<td>8.410</td>
</tr>
<tr>
<td>494.19</td>
<td>11.672</td>
</tr>
<tr>
<td>648.33</td>
<td>10.021</td>
</tr>
</tbody>
</table>

Table D.2 - Identified normal modes for the hinged-hinged beam with two harmonic force inputs

<table>
<thead>
<tr>
<th>Position</th>
<th>Mode 1 x [10^{1}]</th>
<th>Mode 2 x [10^{1}]</th>
<th>Mode 3 x [10^{1}]</th>
<th>Mode 4 x [10^{1}]</th>
<th>Mode 5 x [10^{1}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-1.0774</td>
<td>-2.7529</td>
<td>4.0682</td>
<td>4.7618</td>
<td>-4.9274</td>
</tr>
<tr>
<td>3</td>
<td>-2.4214</td>
<td>-4.7255</td>
<td>5.1187</td>
<td>3.1239</td>
<td>-0.4099</td>
</tr>
<tr>
<td>4</td>
<td>-3.6565</td>
<td>-4.9741</td>
<td>2.0027</td>
<td>-2.8965</td>
<td>4.6762</td>
</tr>
<tr>
<td>5</td>
<td>-4.3895</td>
<td>-3.2095</td>
<td>-2.7771</td>
<td>-4.8207</td>
<td>0.1359</td>
</tr>
<tr>
<td>6</td>
<td>-4.6137</td>
<td>-0.1007</td>
<td>-4.8680</td>
<td>-0.0438</td>
<td>-4.7837</td>
</tr>
<tr>
<td>7</td>
<td>-4.2844</td>
<td>2.9175</td>
<td>-2.8460</td>
<td>4.7831</td>
<td>0.0314</td>
</tr>
<tr>
<td>8</td>
<td>-3.6914</td>
<td>4.7672</td>
<td>1.9263</td>
<td>3.0309</td>
<td>4.7526</td>
</tr>
<tr>
<td>9</td>
<td>-2.6569</td>
<td>4.7833</td>
<td>5.0503</td>
<td>-2.9069</td>
<td>-0.2191</td>
</tr>
<tr>
<td>10</td>
<td>-1.3283</td>
<td>2.9776</td>
<td>3.9585</td>
<td>-4.6472</td>
<td>-4.8786</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position</th>
<th>Mode 6 x [10^{1}]</th>
<th>Mode 7 x [10^{1}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>-4.8896</td>
<td>3.7760</td>
</tr>
<tr>
<td>3</td>
<td>2.4546</td>
<td>4.2764</td>
</tr>
<tr>
<td>4</td>
<td>3.0719</td>
<td>1.4962</td>
</tr>
<tr>
<td>5</td>
<td>-4.5333</td>
<td>2.9315</td>
</tr>
<tr>
<td>6</td>
<td>-0.0551</td>
<td>4.4332</td>
</tr>
<tr>
<td>7</td>
<td>4.6077</td>
<td>2.7099</td>
</tr>
<tr>
<td>8</td>
<td>-2.9897</td>
<td>1.6478</td>
</tr>
<tr>
<td>9</td>
<td>-2.4897</td>
<td>4.2718</td>
</tr>
<tr>
<td>10</td>
<td>4.8393</td>
<td>3.5324</td>
</tr>
</tbody>
</table>

The following figures show the measured frequency response function data and the reconstructed normal mode model without the contributions of the residual terms.
APPENDIX D. MODAL ANALYSIS OF HINGED-HINGED BEAM

ASSESSMENT OF FREQUENCY DOMAIN FORCE IDENTIFICATION PROCEDURES
APPENDIX D. MODAL ANALYSIS OF HINGED-HINGED BEAM

ASSESSMENT OF FREQUENCY DOMAIN FORCE IDENTIFICATION PROCEDURES
APPENDIX D. MODAL ANALYSIS OF HINGED-HINGED BEAM

![Graph 1: Position 5/ Reference 8](image)

![Graph 2: Position 6/ Reference 8](image)

![Graph 3: Position 7/ Reference 8](image)

![Graph 4: Position 8/ Reference 8](image)

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APPENDIX D. MODAL ANALYSIS OF HINGED-HINGED BEAM

ASSESSMENT OF FREQUENCY DOMAIN FORCE IDENTIFICATION PROCEDURES