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CHAPTER 1

INTRODUCTION

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1.1 System Description

The properties of the bodies are given in Tables 1.1 and 1.2. The properties of the connecctions are given in Tables 1.3, 1.4, and 1.5.

Table 1.1: Body CG Locations and Mass

No.	Body Name	Location [m]	Mass [kg]
1	bike	0.678, 0.000, 0.472	165.130
2	upper body	0.415, 0.000, 1.140	33.680
3	upper fork	1.164, 0.000, 0.770	9.990
4	lower fork	1.365, 0.000, 0.324	7.250
5	swing arm	0.196, 0.000, 0.311	8.000
6	bell crank	0.493, 0.000, 0.173	0.000
7	front wheel, bike	1.410, 0.000, 0.282	11.900
8	rear wheel, bike	0.000, 0.000, 0.297	14.700
9	fork rod	1.276, 0.000, 0.550	0.000
10	left fork arm	1.410, 0.100, 0.282	0.000
11	right fork arm	1.410, −0.100, 0.282	0.000
12	lower left arm	1.140, 0.156, 0.200	2.000
13	upper left arm	1.140, 0.175, 0.300	2.000
14	lower right arm	1.140, −0.156, 0.200	2.000
15	upper right arm	1.140, −0.175, 0.300	2.000

Table 1.2: Body Inertia Properties

No.	Body Name	Inertia [kg·m²] (I_{xx}, I_{yy}, I_{zz}; I_{xy}, I_{yz}, I_{zx})
1	bike	11.085, 22.013, 14.982; 0.000, 0.000, 3.691
2	upper body	1.428, 1.347, 0.916; 0.000, 0.000, −0.443
3	upper fork	1.341, 1.548, 0.413; 0.000, 0.000, 0.000
4	lower fork	0.000, 0.000, 0.000; 0.000, 0.000, 0.000
5	swing arm	0.020, 0.259, 0.259; 0.000, 0.000, 0.000
6	bell crank	0.000, 0.000, 0.000; 0.000, 0.000, 0.000
7	front wheel, bike	0.270, 0.484, 0.270; 0.000, 0.000, 0.000
8	rear wheel, bike	0.383, 0.638, 0.383; 0.000, 0.000, 0.000
9	fork rod	0.000, 0.000, 0.000; 0.000, 0.000, 0.000
10	left fork arm	0.000, 0.000, 0.000; 0.000, 0.000, 0.000
11	right fork arm	0.000, 0.000, 0.000; 0.000, 0.000, 0.000
12	lower left arm	0.002, 0.007, 0.009; −0.004, 0.000, 0.000
13	upper left arm	0.004, 0.007, 0.010; −0.005, 0.000, 0.000
14	lower right arm	0.002, 0.007, 0.009; 0.004, 0.000, 0.000
15	upper right arm	0.004, 0.007, 0.010; 0.005, 0.000, 0.000

Note: inertias are defined as the positive integral over the body, e.g., $I_{xy} = +\int r_x r_y \, dm$.

Table 1.3: Connection Location and Direction

No.	Connection Name	Location [m]	Unit Axis
1	rear axle	0.000, 0.000, 0.297	0.000, 1.000, 0.000
2	arm pivot	0.549, 0.000, 0.361	0.000, 1.000, 0.000
3	bell crank pivot	0.539, 0.000, 0.188	0.000, 1.000, 0.000
4	rider	0.364, 0.000, 0.844	0.000, 1.000, 0.000
5	steering head	1.173, 0.000, 0.749	0.407, 0.000, −0.914
6	front axle	1.410, 0.000, 0.282	0.000, 1.000, 0.000
7	left fork joint	1.276, 0.100, 0.550	− , − , −
8	right fork joint	1.276, −0.100, 0.550	− , − , −
9	joint	1.040, 0.212, 0.200	1.000, 0.000, 0.000
10	joint	1.240, 0.100, 0.200	− , − , −
11	joint	1.040, 0.250, 0.300	1.000, 0.000, 0.000
12	joint	1.240, 0.100, 0.300	− , − , −
13	joint	1.040, −0.212, 0.200	1.000, 0.000, 0.000
14	joint	1.240, −0.100, 0.200	− , − , −
15	joint	1.040, −0.250, 0.300	1.000, 0.000, 0.000
16	joint	1.240, −0.100, 0.300	− , − , −
17	right axle	1.410, 0.000, 0.282	− , − , −
18	left axle	1.410, 0.000, 0.282	− , − , −
19	front tire lateral	1.410, 0.000, 0.000	0.000, 1.000, 0.000
20	rear tire lateral	0.000, 0.000, 0.000	0.000, 1.000, 0.000
21	front tire longitudinal	1.410, 0.000, 0.000	1.000, 0.000, 0.000
22	rear tire longitudinal	0.000, 0.000, 0.000	1.000, 0.000, 0.000
23	front tire vertical	1.410, 0.000, 0.000	0.000, 0.000, 1.000
24	rear tire vertical	0.000, 0.000, 0.000	0.000, 0.000, 1.000

Table 1.4: Connection Locations

No.	Connection Name	Location [m]	Location [m]
1	rear spring	0.487, 0.000, 0.489	0.444, 0.000, 0.178
2	right front spring	1.206, −0.100, 0.714	1.276, −0.100, 0.550
3	left front spring	1.206, 0.100, 0.714	1.276, 0.100, 0.550
4	rear pull rod	0.372, 0.000, 0.275	0.495, 0.000, 0.152
5	steer	1.276, 0.000, 0.550	1.164, 0.000, 0.770

Table 1.5: Connection Properties

No.	Connection Name	Stiffness [N/m]	Damping [Ns/m]
1	front tire lateral	0	40,000
2	rear tire lateral	0	40,000
3	front tire longitudinal	0	60,000
4	rear tire longitudinal	0	60,000
5	front tire vertical	130,000	0
6	rear tire vertical	141,000	0
1	rear spring	58,570	11,650
2	right front spring	14,970	1,278
3	left front spring	14,970	1,278

Chapter 2

Analysis

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2.1 Eigenvalue Analysis

The eigenvalue properties are given in Tables 2.1 and 2.2.

Table 2.1: Eigenvalues

No.	Real [rad/s]	Imaginary [rad/s]	Real [Hz]	Imaginary [Hz]
1	$-1.0230304738 \times 10^4$	0.0000000000×10^0	$-1.6282035684 \times 10^3$	0.0000000000×10^0
2	$-8.5532754812 \times 10^3$	0.0000000000×10^0	$-1.3612960725 \times 10^3$	0.0000000000×10^0
3	$-1.3191551907 \times 10^3$	0.0000000000×10^0	$-2.0995006931 \times 10^2$	0.0000000000×10^0
4	$-1.0231574543 \times 10^3$	0.0000000000×10^0	$-1.6284056642 \times 10^2$	0.0000000000×10^0
5	$-1.9641857797 \times 10^2$	0.0000000000×10^0	$-3.1260987599 \times 10^1$	0.0000000000×10^0
6	$-5.5876326297 \times 10^1$	3.5944252884×10^1	$-8.8929935319 \times 10^0$	5.7207055223×10^0
7	$-5.5876326297 \times 10^1$	$-3.5944252884 \times 10^1$	$-8.8929935319 \times 10^0$	$-5.7207055223 \times 10^0$
8	$-1.3751371697 \times 10^1$	3.9852419564×10^1	$-2.1885987798 \times 10^0$	6.3427095677×10^0
9	$-1.3751371697 \times 10^1$	$-3.9852419564 \times 10^1$	$-2.1885987798 \times 10^0$	$-6.3427095677 \times 10^0$
10	$-1.0430640723 \times 10^1$	1.7674898769×10^1	$-1.6600880306 \times 10^0$	2.8130475078×10^0
11	$-1.0430640723 \times 10^1$	$-1.7674898769 \times 10^1$	$-1.6600880306 \times 10^0$	$-2.8130475078 \times 10^0$
12	$-2.0308851446 \times 10^1$	0.0000000000×10^0	$-3.2322540962 \times 10^0$	0.0000000000×10^0
13	$-1.3346363096 \times 10^0$	1.0070936061×10^1	$-2.1241396591 \times 10^{-1}$	1.6028392557×10^0
14	$-1.3346363096 \times 10^0$	$-1.0070936061 \times 10^1$	$-2.1241396591 \times 10^{-1}$	$-1.6028392557 \times 10^0$
15	3.5225204483×10^0	0.0000000000×10^0	$5.6062654149 \times 10^{-1}$	0.0000000000×10^0
16	$-3.6040166709 \times 10^0$	0.0000000000×10^0	$-5.7359706816 \times 10^{-1}$	0.0000000000×10^0
17	$-1.6253442872 \times 10^{-5}$	0.0000000000×10^0	$-2.5868157754 \times 10^{-6}$	0.0000000000×10^0
18	$-8.9927897575 \times 10^{-7}$	0.0000000000×10^0	$-1.4312469421 \times 10^{-7}$	0.0000000000×10^0
19	$1.6253449071 \times 10^{-5}$	0.0000000000×10^0	$2.5868167619 \times 10^{-6}$	0.0000000000×10^0
20	$8.9927831611 \times 10^{-7}$	0.0000000000×10^0	$1.4312458922 \times 10^{-7}$	0.0000000000×10^0
21	$-5.9639080974 \times 10^{-12}$	0.0000000000×10^0	$-9.4918545385 \times 10^{-13}$	0.0000000000×10^0
22	$-7.3592541129 \times 10^{-13}$	0.0000000000×10^0	$-1.1712616695 \times 10^{-13}$	0.0000000000×10^0

Note: oscillatory roots appear as complex conjugates.

Table 2.2: Eigenvalue Analysis

No.	Frequency (ω_{n}) [Hz]	Damping Ratio (ζ)	Time Constant (τ) [s]	Wavelength (λ) [s]
1	–	–	$9.7748798848 \times 10^{-5}$	–
2	–	–	$1.1691427479 \times 10^{-4}$	–
3	–	–	$7.5806092189 \times 10^{-4}$	–
4	–	–	$9.7736667584 \times 10^{-4}$	–
5	–	–	$5.0911681082 \times 10^{-3}$	–
6	$1.0574110158 \times 10^{1}$	$8.4101578281 \times 10^{-1}$	$1.7896666912 \times 10^{-2}$	$1.7480361401 \times 10^{-1}$
7	$1.0574110158 \times 10^{1}$	$8.4101578281 \times 10^{-1}$	$1.7896666912 \times 10^{-2}$	$1.7480361401 \times 10^{-1}$
8	$6.7096892088 \times 10^{0}$	$3.2618482193 \times 10^{-1}$	$7.2720018196 \times 10^{-2}$	$1.5766132586 \times 10^{-1}$
9	$6.7096892088 \times 10^{0}$	$3.2618482193 \times 10^{-1}$	$7.2720018196 \times 10^{-2}$	$1.5766132586 \times 10^{-1}$
10	$3.2663631994 \times 10^{0}$	$5.0823742777 \times 10^{-1}$	$9.5871387634 \times 10^{-2}$	$3.5548635323 \times 10^{-1}$
11	$3.2663631994 \times 10^{0}$	$5.0823742777 \times 10^{-1}$	$9.5871387634 \times 10^{-2}$	$3.5548635323 \times 10^{-1}$
12	–	–	$4.9239613705 \times 10^{-2}$	–
13	$1.6168529224 \times 10^{0}$	$1.3137494633 \times 10^{-1}$	$7.4926779138 \times 10^{-1}$	$6.2389288036 \times 10^{-1}$
14	$1.6168529224 \times 10^{0}$	$1.3137494633 \times 10^{-1}$	$7.4926779138 \times 10^{-1}$	$6.2389288036 \times 10^{-1}$
15	–	–	$-2.8388763520 \times 10^{-1}$	–
16	–	–	$2.7746819488 \times 10^{-1}$	–
17	–	–	$6.1525426204 \times 10^{4}$	–
18	–	–	$1.1120019782 \times 10^{6}$	–
19	–	–	$-6.1525402741 \times 10^{4}$	–
20	–	–	$-1.1120027939 \times 10^{6}$	–
21	–	–	$1.6767528669 \times 10^{11}$	–
22	–	–	$1.3588333609 \times 10^{12}$	–

Notes: a) oscillatory roots are listed twice, b) negative time constants denote unstable roots.

There are 11 degrees of freedom.

There are 4 oscillatory modes, 15 damped modes, 3 unstable modes, and 0 rigid body modes.
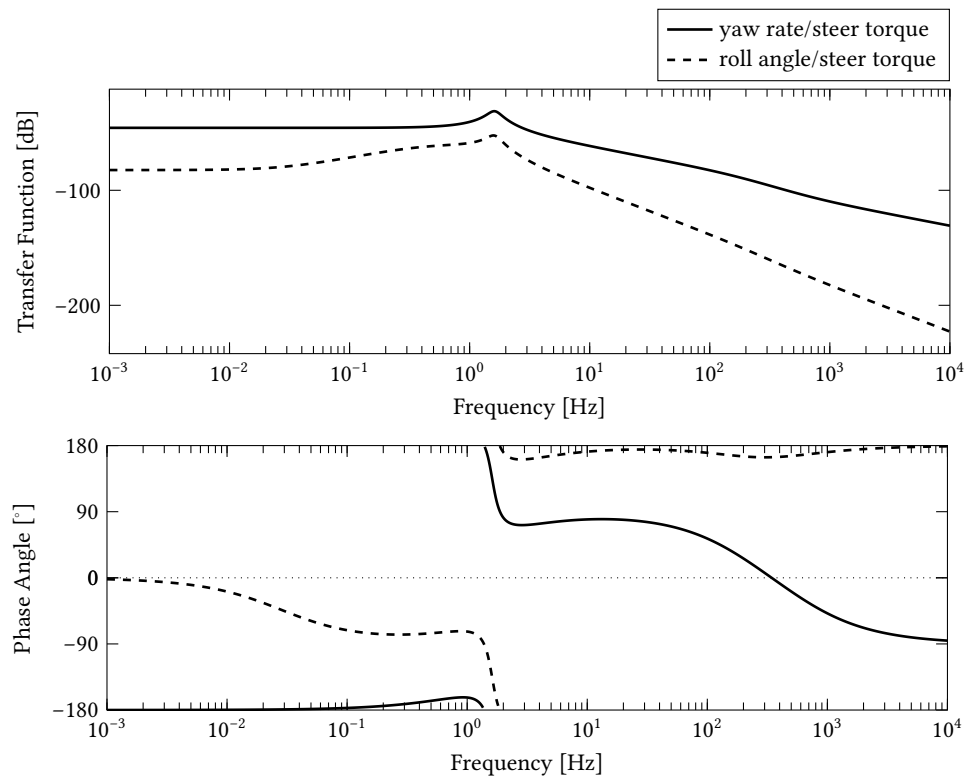
2.2 Frequency Response Plots

Figure 2.1: Frequency response: steer torque

2.3   Steady State Gains

The steady state gains are given in Table 2.3.

Table 2.3: Steady State Gains

No.	Output/Input	Gain
1	yaw rate/steer torque	$-5.1894100000 \times 10^{-3}$
2	roll angle/steer torque	$7.5820000000 \times 10^{-5}$

2.4   Equilibrium Analysis

The results of the equlibrium load analysis are given in Tables 2.4 and 2.5.

Table 2.4: System Static Deflections

No.	Body Name	Type	Deflection [m] or [rad]
1	bike	translation	-9.9700×10^{-5}, 0.0000×10^{0}, -6.0740×10^{-2}
–	–	rotation	0.0000×10^{0}, -1.6713×10^{-2}, 0.0000×10^{0}
2	upper body	translation	-1.1257×10^{-2}, 0.0000×10^{0}, -6.5133×10^{-2}
–	–	rotation	0.0000×10^{0}, -1.6713×10^{-2}, 0.0000×10^{0}
3	upper fork	translation	-5.0734×10^{-3}, 0.0000×10^{0}, -5.2615×10^{-2}
–	–	rotation	1.0000×10^{-8}, -1.6713×10^{-2}, -2.0000×10^{-8}
4	lower fork	translation	2.3805×10^{-3}, 0.0000×10^{0}, -1.0113×10^{-2}
–	–	rotation	1.0000×10^{-8}, -1.6713×10^{-2}, -2.0000×10^{-8}
5	swing arm	translation	-3.0610×10^{-3}, 0.0000×10^{0}, -2.8475×10^{-2}
–	–	rotation	0.0000×10^{0}, 9.7503×10^{-2}, 1.0000×10^{-8}
6	bell crank	translation	-7.4551×10^{-4}, 0.0000×10^{0}, -4.6436×10^{-2}
–	–	rotation	-1.0000×10^{-8}, 3.5856×10^{-1}, 0.0000×10^{0}
7	front wheel, bike	translation	3.0824×10^{-3}, 0.0000×10^{0}, -9.3610×10^{-3}
–	–	rotation	1.0000×10^{-8}, 0.0000×10^{0}, -2.0000×10^{-8}
8	rear wheel, bike	translation	-4.4552×10^{-3}, 0.0000×10^{0}, -9.3647×10^{-3}
–	–	rotation	0.0000×10^{0}, 0.0000×10^{0}, 0.0000×10^{0}
9	fork rod	translation	-1.4046×10^{-3}, 0.0000×10^{0}, -1.1598×10^{-2}
–	–	rotation	1.0000×10^{-8}, -1.6713×10^{-2}, -2.0000×10^{-8}
10	left fork arm	translation	3.0824×10^{-3}, 0.0000×10^{0}, -9.3610×10^{-3}
–	–	rotation	1.0000×10^{-8}, -1.6713×10^{-2}, -2.0000×10^{-8}
11	right fork arm	translation	3.0824×10^{-3}, 0.0000×10^{0}, -9.3610×10^{-3}
–	–	rotation	1.0000×10^{-8}, -1.6713×10^{-2}, -2.0000×10^{-8}
12	lower left arm	translation	4.4529×10^{-3}, 0.0000×10^{0}, -3.3445×10^{-2}
–	–	rotation	0.0000×10^{0}, -2.1243×10^{-1}, 3.0000×10^{-8}
13	upper left arm	translation	2.7816×10^{-3}, 0.0000×10^{0}, -3.3445×10^{-2}
–	–	rotation	0.0000×10^{0}, -2.1243×10^{-1}, 2.0000×10^{-8}
14	lower right arm	translation	4.4529×10^{-3}, 0.0000×10^{0}, -3.3445×10^{-2}
–	–	rotation	0.0000×10^{0}, -2.1243×10^{-1}, 3.0000×10^{-8}
15	upper right arm	translation	2.7816×10^{-3}, 0.0000×10^{0}, -3.3445×10^{-2}
–	–	rotation	0.0000×10^{0}, -2.1243×10^{-1}, 2.0000×10^{-8}

Table 2.5: System Preloads

No.	Connector Name	Type	Load [N] or [Nm] (Components; Magnitude)
1	rear axle	force	0.0000×10^0, 0.0000×10^0, 1.1762×10^3; 1.1762×10^3
2	arm pivot	force	-2.3492×10^3, 0.0000×10^0, 1.2553×10^3; 2.6635×10^3
3	bell crank pivot	force	2.6261×10^3, 0.0000×10^0, -3.3862×10^2; 2.6478×10^3
4	rider	force	0.0000×10^0, 0.0000×10^0, 3.3040×10^2; 3.3040×10^2
–	–	moment	0.0000×10^0, -1.6850×10^1, 0.0000×10^0; 1.6850×10^1
5	steering head	force	4.2458×10^2, 0.0000×10^0, -8.9183×10^2; 9.8774×10^2
–	–	moment	0.0000×10^0, 1.8686×10^1, 0.0000×10^0; 1.8686×10^1
6	front axle	force	0.0000×10^0, 0.0000×10^0, 1.1002×10^3; 1.1002×10^3
7	left fork joint	force	2.1229×10^2, -6.4894×10^1, -4.9491×10^2; 5.4242×10^2
–	–	moment	1.3080×10^1, 0.0000×10^0, 6.3183×10^0; 1.4526×10^1
8	right fork joint	force	2.1229×10^2, 6.4894×10^1, -4.9491×10^2; 5.4242×10^2
–	–	moment	-1.3080×10^1, 0.0000×10^0, -6.3183×10^0; 1.4526×10^1
9	joint	force	-1.8010×10^2, 1.0129×10^2, 9.8100×10^0; 2.0686×10^2
10	joint	force	1.8010×10^2, -1.0129×10^2, 9.8100×10^0; 2.0686×10^2
11	joint	force	-3.2189×10^1, 2.4142×10^1, 9.8100×10^0; 4.1415×10^1
12	joint	force	3.2189×10^1, -2.4142×10^1, 9.8100×10^0; 4.1415×10^1
13	joint	force	-1.8010×10^2, -1.0129×10^2, 9.8100×10^0; 2.0686×10^2
14	joint	force	1.8010×10^2, 1.0129×10^2, 9.8100×10^0; 2.0686×10^2
15	joint	force	-3.2189×10^1, -2.4142×10^1, 9.8100×10^0; 4.1415×10^1
16	joint	force	3.2189×10^1, 2.4142×10^1, 9.8100×10^0; 4.1415×10^1
17	right axle	force	0.0000×10^0, 6.0537×10^1, 5.1453×10^2; 5.1808×10^2
–	–	moment	-1.3080×10^1, -1.6003×10^0, -6.3183×10^0; 1.4614×10^1
18	left axle	force	0.0000×10^0, -6.0537×10^1, 5.1453×10^2; 5.1808×10^2
–	–	moment	1.3080×10^1, -1.6003×10^0, 6.3183×10^0; 1.4614×10^1
19	front tire lateral	force	0.0000×10^0, 0.0000×10^0, 0.0000×10^0; 0.0000×10^0
20	rear tire lateral	force	0.0000×10^0, 0.0000×10^0, 0.0000×10^0; 0.0000×10^0
21	front tire longitudinal	force	0.0000×10^0, 0.0000×10^0, 0.0000×10^0; 0.0000×10^0
22	rear tire longitudinal	force	0.0000×10^0, 0.0000×10^0, 0.0000×10^0; 0.0000×10^0
23	front tire vertical	force	0.0000×10^0, 0.0000×10^0, 1.2169×10^3; 1.2169×10^3
24	rear tire vertical	force	0.0000×10^0, 0.0000×10^0, 1.3204×10^3; 1.3204×10^3
25	rear spring	force	2.7693×10^2, 0.0000×10^0, 2.0144×10^3; -2.0333×10^3
26	right front spring	force	-2.1229×10^2, 0.0000×10^0, 4.9491×10^2; -5.3852×10^2
27	left front spring	force	-2.1229×10^2, 0.0000×10^0, 4.9491×10^2; -5.3852×10^2
28	rear pull rod	force	2.3492×10^3, 0.0000×10^0, -2.3530×10^3; 3.3249×10^3
29	steer	force	0.0000×10^0, 0.0000×10^0, 0.0000×10^0; 0.0000×10^0

Chapter 3

Conclusion

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Appendix A

Equations of Motion

The equations of motion are of the form

$$\begin{bmatrix} I & 0 & 0 \\ 0 & M & -G \\ 0 & 0 & 0 \end{bmatrix} \begin{Bmatrix} \dot{p} \\ \dot{w} \\ \dot{u} \end{Bmatrix} + \begin{bmatrix} V & -I & 0 \\ K & L & -F \\ 0 & 0 & I \end{bmatrix} \begin{Bmatrix} p \\ w \\ u \end{Bmatrix} = \begin{bmatrix} 0 \\ 0 \\ I \end{bmatrix} \begin{Bmatrix} u \end{Bmatrix}$$

The mass matrix of the system is

Row	Column	Value	Row	Column	Value
1	1	1.65130000×10^2	44	44	1.47000000×10^1
2	2	1.65130000×10^2	45	45	1.47000000×10^1
3	3	1.65130000×10^2	46	46	$3.83000000 \times 10^{-1}$
4	4	1.10850000×10^1	47	47	$6.38000000 \times 10^{-1}$
6	4	-3.69100000×10^0	48	48	$3.83000000 \times 10^{-1}$
5	5	2.20130000×10^1	67	67	2.00000000×10^0
4	6	-3.69100000×10^0	68	68	2.00000000×10^0
6	6	1.49820000×10^1	69	69	2.00000000×10^0
7	7	3.36800000×10^1	70	70	$2.10862507 \times 10^{-3}$
8	8	3.36800000×10^1	71	70	$3.74933333 \times 10^{-3}$
9	9	3.36800000×10^1	70	71	$3.74933333 \times 10^{-3}$
10	10	1.42800000×10^0	71	71	$6.66666667 \times 10^{-3}$
12	10	$4.43000000 \times 10^{-1}$	72	72	$8.77529173 \times 10^{-3}$
11	11	1.34700000×10^0	73	73	2.00000000×10^0
10	12	$4.43000000 \times 10^{-1}$	74	74	2.00000000×10^0
12	12	$9.16000000 \times 10^{-1}$	75	75	2.00000000×10^0
13	13	9.99000000×10^0	76	76	$3.75000000 \times 10^{-3}$
14	14	9.99000000×10^0	77	76	$5.00000000 \times 10^{-3}$
15	15	9.99000000×10^0	76	77	$5.00000000 \times 10^{-3}$
16	16	1.34100000×10^0	77	77	$6.66666667 \times 10^{-3}$
17	17	1.54800000×10^0	78	78	$1.04166667 \times 10^{-2}$
18	18	$4.12500000 \times 10^{-1}$	79	79	2.00000000×10^0
19	19	7.25000000×10^0	80	80	2.00000000×10^0
20	20	7.25000000×10^0	81	81	2.00000000×10^0
21	21	7.25000000×10^0	82	82	$2.10862507 \times 10^{-3}$
25	25	8.00000000×10^0	83	82	$-3.74933333 \times 10^{-3}$

26	26	8.00000000×10^0	82	83	$-3.74933333 \times 10^{-3}$
27	27	8.00000000×10^0	83	83	$6.66666667 \times 10^{-3}$
28	28	$2.00000000 \times 10^{-2}$	84	84	$8.77529173 \times 10^{-3}$
29	29	$2.59000000 \times 10^{-1}$	85	85	2.00000000×10^0
30	30	$2.59000000 \times 10^{-1}$	86	86	2.00000000×10^0
37	37	1.19000000×10^1	87	87	2.00000000×10^0
38	38	1.19000000×10^1	88	88	$3.75000000 \times 10^{-3}$
39	39	1.19000000×10^1	89	88	$-5.00000000 \times 10^{-3}$
40	40	$2.70000000 \times 10^{-1}$	88	89	$-5.00000000 \times 10^{-3}$
41	41	$4.84000000 \times 10^{-1}$	89	89	$6.66666667 \times 10^{-3}$
42	42	$2.70000000 \times 10^{-1}$	90	90	$1.04166667 \times 10^{-2}$
43	43	1.47000000×10^1	–	–	–

The damping matrix is

Row	Column	Value	Row	Column	Value
1	1	2.16096323×10^2	1	33	-1.57188566×10^3
3	1	1.57188566×10^3	3	33	-1.14339037×10^4
5	1	3.03616953×10^2	5	33	-2.20851114×10^3
31	1	-2.16096323×10^2	31	33	1.57188566×10^3
33	1	-1.57188566×10^3	33	33	1.14339037×10^4
35	1	-7.71558003×10^1	35	33	5.61231653×10^2
1	3	1.57188566×10^3	1	35	-7.71558003×10^1
3	3	1.14339037×10^4	3	35	-5.61231653×10^2
5	3	2.20851114×10^3	5	35	-1.08404478×10^2
31	3	-1.57188566×10^3	31	35	7.71558003×10^1
33	3	-1.14339037×10^4	33	35	5.61231653×10^2
35	3	-5.61231653×10^2	35	35	2.75479816×10^1
1	5	3.03616953×10^2	37	37	6.00000000×10^4
3	5	2.20851114×10^3	41	37	-1.69200000×10^4
5	5	4.26584094×10^2	38	38	4.00000000×10^4
31	5	-3.03616953×10^2	40	38	1.12800000×10^4
33	5	-2.20851114×10^3	38	40	1.12800000×10^4
35	5	-1.08404478×10^2	40	40	3.18096000×10^3
13	13	3.97153697×10^2	37	41	-1.69200000×10^4
15	13	-9.25888830×10^2	41	41	4.77144000×10^3
17	13	1.66467238×10^1	43	43	6.00000000×10^4
49	13	-3.97153697×10^2	47	43	-1.78200000×10^4
51	13	9.25888830×10^2	44	44	4.00000000×10^4
13	15	-9.25888830×10^2	46	44	1.18800000×10^4
15	15	2.15853493×10^3	44	46	1.18800000×10^4
17	15	-3.88086924×10^1	46	46	3.52836000×10^3
49	15	9.25888830×10^2	43	47	-1.78200000×10^4
51	15	-2.15853493×10^3	47	47	5.29254000×10^3
16	16	2.15853493×10^1	13	49	-3.97153697×10^2
18	16	9.25888830×10^0	15	49	9.25888830×10^2
52	16	-2.15853493×10^1	17	49	-1.66467238×10^1
54	16	-9.25888830×10^0	49	49	3.97153697×10^2
13	17	1.66467238×10^1	51	49	-9.25888830×10^2
15	17	-3.88086924×10^1	13	51	9.25888830×10^2
17	17	$6.97748546 \times 10^{-1}$	15	51	-2.15853493×10^3
49	17	-1.66467238×10^1	17	51	3.88086924×10^1
51	17	3.88086924×10^1	49	51	-9.25888830×10^2
16	18	9.25888830×10^0	51	51	2.15853493×10^3
18	18	3.97153697×10^0	16	52	-2.15853493×10^1

Row	Column	Value	Row	Column	Value
52	18	-9.25888830×10^0	18	52	-9.25888830×10^0
54	18	-3.97153697×10^0	52	52	2.15853493×10^1
1	31	-2.16096323×10^2	54	52	9.25888830×10^0
3	31	-1.57188566×10^3	16	54	-9.25888830×10^0
5	31	-3.03616953×10^2	18	54	-3.97153697×10^0
31	31	2.16096323×10^2	52	54	9.25888830×10^0
33	31	1.57188566×10^3	54	54	3.97153697×10^0
35	31	7.71558003×10^1	–	–	–

The stiffness matrix is

Row	Column	Value	Row	Column	Value
1	1	-5.27876227×10^3	16	50	3.38983024×10^2
3	1	8.77766307×10^3	18	50	2.54237268×10^2
5	1	1.98354865×10^3	50	50	-6.05326828×10^3
31	1	5.27876227×10^3	52	50	9.89828562×10^2
33	1	-8.77766307×10^3	54	50	4.24580208×10^2
35	1	-3.95396481×10^2	13	51	1.30398812×10^4
2	2	-6.48547899×10^3	15	51	-2.43467517×10^4
4	2	-2.88102620×10^2	17	51	2.92330226×10^2
6	2	1.51500789×10^3	49	51	-1.30398812×10^4
32	2	6.48547899×10^3	51	51	2.43467517×10^4
34	2	-3.54539518×10^1	53	51	-4.24580208×10^2
36	2	-3.13464818×10^2	16	52	-2.43467517×10^2
1	3	8.77766307×10^3	18	52	-1.30398812×10^2
3	3	5.73632833×10^4	52	52	2.43467517×10^2
5	3	1.08176745×10^4	54	52	1.30398812×10^2
31	3	-8.77766307×10^3	16	54	-1.30398812×10^2
33	3	-5.73632833×10^4	18	54	4.59900217×10^0
35	3	-2.82054325×10^3	52	54	1.30398812×10^2
2	4	1.06361855×10^2	54	54	-4.59900217×10^0
4	4	2.43481740×10^1	23	55	-5.14534281×10^2
6	4	-2.61021306×10^1	24	55	-6.05366365×10^1
32	4	-1.06361855×10^2	53	55	4.94914281×10^2
34	4	$5.81444810 \times 10^{-1}$	54	55	-6.48940571×10^1
36	4	5.14082301×10^0	59	55	1.96200000×10^1
1	5	1.58908418×10^3	60	55	1.25430694×10^2
3	5	1.10946045×10^4	22	56	5.14534281×10^2
5	5	2.12419103×10^3	52	56	-4.94914281×10^2
31	5	-1.58908418×10^3	54	56	-2.12290104×10^2
33	5	-1.10946045×10^4	58	56	-1.96200000×10^1
35	5	-5.44926209×10^2	60	56	2.12290104×10^2
2	6	1.23807794×10^3	22	57	6.05366365×10^1
4	6	3.78001358×10^2	52	57	6.48940571×10^1
6	6	-2.82271523×10^2	53	57	2.12290104×10^2
32	6	-1.23807794×10^3	58	57	-1.25430694×10^2
34	6	6.76815940×10^0	59	57	-2.12290104×10^2
36	6	5.98404337×10^1	22	58	-6.05366365×10^0
5	7	-3.30400800×10^2	52	58	1.32874739×10^2
4	8	3.30400800×10^2	54	58	5.69957127×10^1
4	10	9.78647170×10^1	58	58	-1.26821075×10^2
10	10	-9.78647170×10^1	59	58	1.26365420×10^1
12	10	1.68504408×10^1	60	58	-5.53954564×10^1
5	11	9.78647170×10^1	52	59	8.68667591×10^0
11	11	-9.78647170×10^1	53	59	1.61291753×10^2

4	12	-1.68504408×10^1	54	59	-1.74227765×10^1
5	13	8.91826662×10^2	58	59	-2.13232179×10^1
13	13	-4.59900217×10^2	59	59	-1.61291753×10^2
15	13	-1.30398812×10^4	60	59	4.35823192×10^1
17	13	5.73429421×10^2	23	60	-5.14534281×10^1
49	13	4.59900217×10^2	24	60	-6.05366365×10^0
51	13	1.30398812×10^4	52	60	6.62489009×10^1
4	14	-8.91826662×10^2	54	60	2.84170141×10^1
6	14	-4.24580208×10^2	58	60	-6.78491572×10^1
14	14	-6.05326828×10^3	59	60	2.52938853×10^1
16	14	-3.38983024×10^2	60	60	-2.23633504×10^1
18	14	-2.54237268×10^2	23	61	-5.14534281×10^2
50	14	6.05326828×10^3	24	61	6.05366365×10^1
5	15	4.24580208×10^2	53	61	4.94914281×10^2
13	15	-1.30398812×10^4	54	61	6.48940571×10^1
15	15	2.43467517×10^4	65	61	1.96200000×10^1
17	15	-2.92330226×10^2	66	61	-1.25430694×10^2
49	15	1.30398812×10^4	22	62	5.14534281×10^2
51	15	-2.43467517×10^4	52	62	-4.94914281×10^2
4	16	-1.87283599×10^1	54	62	-2.12290104×10^2
6	16	-8.91618438×10^0	64	62	-1.96200000×10^1
14	16	-3.38983024×10^2	66	62	2.12290104×10^2
16	16	1.94725912×10^2	22	63	-6.05366365×10^1
18	16	8.57067778×10^1	52	63	-6.48940571×10^1
50	16	3.38983024×10^2	53	63	2.12290104×10^2
52	16	-2.43467517×10^2	64	63	1.25430694×10^2
54	16	-1.30398812×10^2	65	63	-2.12290104×10^2
5	17	-2.25495818×10^1	22	64	-6.05366365×10^0
13	17	5.73429421×10^2	52	64	1.32874739×10^2
15	17	-2.92330226×10^2	54	64	5.69957127×10^1
17	17	-7.05473645×10^1	64	64	-1.26821075×10^2
49	17	-5.73429421×10^2	65	64	-1.26365420×10^1
51	17	2.92330226×10^2	66	64	-5.53954564×10^1
4	18	-8.02643996×10^0	52	65	-8.68667591×10^0
6	18	-3.82122188×10^0	53	65	1.61291753×10^2
14	18	-2.54237268×10^2	54	65	1.74227765×10^1
16	18	8.57067778×10^1	64	65	2.13232179×10^1
18	18	-3.62315982×10^1	65	65	-1.61291753×10^2
50	18	2.54237268×10^2	66	65	-4.35823192×10^1
52	18	-1.30398812×10^2	23	66	5.14534281×10^1
54	18	4.59900217×10^0	24	66	-6.05366365×10^0
23	19	1.02906856×10^3	52	66	6.62489009×10^1
41	19	-1.10019106×10^3	54	66	2.84170141×10^1
22	20	-1.02906856×10^3	64	66	-6.78491572×10^1
40	20	1.10019106×10^3	65	66	-2.52938853×10^1
22	22	-4.62080246×10^1	66	66	-2.23633504×10^1
24	22	-3.20051250×10^0	5	67	-9.81000000×10^0
40	22	4.62080246×10^1	6	67	1.01288613×10^2
23	23	-4.62080246×10^1	59	67	-9.81000000×10^0
41	23	4.62080246×10^1	60	67	-1.01288613×10^2
22	24	-4.63080853×10^1	4	68	9.81000000×10^0
40	24	4.95085978×10^1	6	68	1.80100664×10^2
5	25	-1.25527100×10^3	58	68	9.81000000×10^0
25	25	9.61195795×10^3	60	68	-1.80100664×10^2
27	25	9.59627775×10^3	4	69	-1.01288613×10^2
29	25	-2.04170061×10^3	5	69	-1.80100664×10^2
31	25	-9.61195795×10^3	58	69	1.01288613×10^2
33	25	-9.59627775×10^3	59	69	1.80100664×10^2
35	25	2.16238216×10^2	4	70	-5.69647162×10^0

47	25	-1.17621944×10^3	5	70	-1.01288613×10^1
4	26	1.25527100×10^3	58	70	-5.69647162×10^0
6	26	2.34917193×10^3	59	70	-1.01288613×10^1
26	26	1.91925811×10^4	70	70	1.13929432×10^1
28	26	7.00529210×10^2	71	70	2.02577227×10^1
30	26	3.38173279×10^3	4	71	-1.01288613×10^1
32	26	-1.91925811×10^4	5	71	-1.80100664×10^1
34	26	-3.94087665×10^2	58	71	-1.01288613×10^1
36	26	-3.77454095×10^1	59	71	-1.80100664×10^1
46	26	1.17621944×10^3	70	71	2.02577227×10^1
5	27	-2.34917193×10^3	71	71	3.60201328×10^1
25	27	9.59627775×10^3	4	72	$-9.81000000 \times 10^{-1}$
27	27	9.58062314×10^3	5	72	$5.51714400 \times 10^{-1}$
29	27	-2.03836994×10^3	6	72	-2.37065380×10^1
31	27	-9.59627775×10^3	58	72	$9.81000000 \times 10^{-1}$
33	27	-9.58062314×10^3	59	72	$-5.51714400 \times 10^{-1}$
35	27	2.15885462×10^2	60	72	-2.37065380×10^1
4	28	-6.21359147×10^1	72	72	4.74130760×10^1
6	28	-1.16284010×10^2	5	73	-9.81000000×10^0
26	28	7.00529210×10^2	6	73	2.41420802×10^1
28	28	1.56770174×10^2	59	73	-9.81000000×10^0
30	28	3.25462032×10^2	60	73	-2.41420802×10^1
32	28	-7.00529210×10^2	4	74	9.81000000×10^0
34	28	-1.43841998×10^1	6	74	3.21894403×10^1
36	28	-1.37770745×10^0	58	74	9.81000000×10^0
46	28	1.68199380×10^1	60	74	-3.21894403×10^1
5	29	7.67121775×10^2	4	75	-2.41420802×10^1
25	29	-2.04170061×10^3	5	75	-3.21894403×10^1
27	29	-2.03836994×10^3	58	75	2.41420802×10^1
29	29	1.49550116×10^2	59	75	3.21894403×10^1
31	29	2.04170061×10^3	4	76	-1.81065602×10^0
33	29	2.03836994×10^3	5	76	-2.41420802×10^0
35	29	-4.59317133×10^1	58	76	-1.81065602×10^0
47	29	1.68199380×10^1	59	76	-2.41420802×10^0
4	30	4.43110664×10^2	76	76	3.62131203×10^0
6	30	8.29257690×10^2	77	76	4.82841605×10^0
26	30	3.38173279×10^3	4	77	-2.41420802×10^0
28	30	3.25462032×10^2	5	77	-3.21894403×10^0
30	30	1.80527721×10^2	58	77	-2.41420802×10^0
32	30	-3.38173279×10^3	59	77	-3.21894403×10^0
34	30	-6.94382466×10^1	76	77	4.82841605×10^0
36	30	-6.65074115×10^0	77	77	6.43788806×10^0
46	30	-2.30539010×10^2	4	78	$-9.81000000 \times 10^{-1}$
1	31	5.27876227×10^3	5	78	$7.35750000 \times 10^{-1}$
3	31	-8.77766307×10^3	6	78	-5.02960005×10^0
5	31	-1.25046351×10^3	58	78	$9.81000000 \times 10^{-1}$
25	31	-9.61195795×10^3	59	78	$-7.35750000 \times 10^{-1}$
27	31	-9.59627775×10^3	60	78	-5.02960005×10^0
29	31	2.04170061×10^3	78	78	1.00592001×10^1
31	31	4.33319567×10^3	5	79	-9.81000000×10^0
33	31	1.83739408×10^4	6	79	-1.01288613×10^2
35	31	1.79158265×10^2	65	79	-9.81000000×10^0
2	32	6.48547899×10^3	66	79	1.01288613×10^2
4	32	-4.44982522×10^2	4	80	9.81000000×10^0
6	32	-3.86417982×10^3	6	80	1.80100664×10^2
26	32	-1.91925811×10^4	64	80	9.81000000×10^0
28	32	-7.00529210×10^2	66	80	-1.80100664×10^2
30	32	-3.38173279×10^3	4	81	1.01288613×10^2
32	32	1.27071021×10^4	5	81	-1.80100664×10^2

34	32	4.29541617×10^2	64	81	-1.01288613×10^2
36	32	3.51210227×10^2	65	81	1.80100664×10^2
1	33	-8.77766307×10^3	4	82	-5.69647162×10^0
3	33	-5.73632833×10^4	5	82	1.01288613×10^1
5	33	-8.46850257×10^3	64	82	-5.69647162×10^0
25	33	-9.59627775×10^3	65	82	1.01288613×10^1
27	33	-9.58062314×10^3	82	82	1.13929432×10^1
29	33	2.03836994×10^3	83	82	-2.02577227×10^1
31	33	1.83739408×10^4	4	83	1.01288613×10^1
33	33	6.69439064×10^4	5	83	-1.80100664×10^1
35	33	2.60465779×10^3	64	83	1.01288613×10^1
2	34	-3.54539518×10^1	65	83	-1.80100664×10^1
4	34	5.68332952×10^0	82	83	-2.02577227×10^1
6	34	4.63347610×10^1	83	83	3.60201328×10^1
26	34	-3.94087665×10^2	4	84	$-9.81000000 \times 10^{-1}$
28	34	-1.43841998×10^1	5	84	$-5.51714400 \times 10^{-1}$
30	34	-6.94382466×10^1	6	84	-2.37065380×10^1
32	34	4.29541617×10^2	64	84	$9.81000000 \times 10^{-1}$
34	34	-5.65309114×10^1	65	84	$5.51714400 \times 10^{-1}$
36	34	-8.72276167×10^1	66	84	-2.37065380×10^1
1	35	-3.95396481×10^2	84	84	4.74130760×10^1
3	35	-2.82054325×10^3	5	85	-9.81000000×10^0
5	35	-6.61587914×10^2	6	85	-2.41420802×10^1
25	35	2.16238216×10^2	65	85	-9.81000000×10^0
27	35	2.15885462×10^2	66	85	2.41420802×10^1
29	35	-4.59317133×10^1	4	86	9.81000000×10^0
31	35	1.79158265×10^2	6	86	3.21894403×10^1
33	35	2.60465779×10^3	64	86	9.81000000×10^0
35	35	2.09451894×10^2	66	86	-3.21894403×10^1
2	36	-3.13464818×10^2	4	87	2.41420802×10^1
4	36	-1.05598886×10^1	5	87	-3.21894403×10^1
6	36	-6.19231567×10^1	64	87	-2.41420802×10^1
26	36	-3.77454095×10^1	65	87	3.21894403×10^1
28	36	-1.37770745×10^0	4	88	-1.81065602×10^0
30	36	-6.65074115×10^0	5	88	2.41420802×10^0
32	36	3.51210227×10^2	64	88	-1.81065602×10^0
34	36	-8.72276167×10^1	65	88	2.41420802×10^0
36	36	1.15451933×10^2	88	88	3.62131203×10^0
41	37	1.10019106×10^3	89	88	-4.82841604×10^0
40	38	-1.10019106×10^3	4	89	2.41420802×10^0
39	39	1.30000000×10^5	5	89	-3.21894403×10^0
40	40	-3.43174277×10^2	64	89	2.41420802×10^0
47	43	1.17621944×10^3	65	89	-3.21894403×10^0
46	44	-1.17621944×10^3	88	89	-4.82841604×10^0
45	45	1.41000000×10^5	89	89	6.43788805×10^0
46	46	-3.92166652×10^2	4	90	$-9.81000000 \times 10^{-1}$
13	49	4.59900217×10^2	5	90	$-7.35750000 \times 10^{-1}$
15	49	1.30398812×10^4	6	90	-5.02960004×10^0
17	49	-5.73429421×10^2	64	90	$9.81000000 \times 10^{-1}$
49	49	-4.59900217×10^2	65	90	$7.35750000 \times 10^{-1}$
51	49	-1.30398812×10^4	66	90	-5.02960004×10^0
53	49	-9.89828562×10^2	90	90	1.00592001×10^1
14	50	6.05326828×10^3	–	–	–

The velocity matrix is

Row	Column	Value	Row	Column	Value
3	5	1.00000000×10^0	44	48	-1.00000000×10^0
2	6	-1.00000000×10^0	51	53	1.00000000×10^0
9	11	1.00000000×10^0	50	54	-1.00000000×10^0
8	12	-1.00000000×10^0	57	59	1.00000000×10^0
15	17	1.00000000×10^0	56	60	-1.00000000×10^0
14	18	-1.00000000×10^0	63	65	1.00000000×10^0
21	23	1.00000000×10^0	62	66	-1.00000000×10^0
20	24	-1.00000000×10^0	69	71	1.00000000×10^0
27	29	1.00000000×10^0	68	72	-1.00000000×10^0
26	30	-1.00000000×10^0	75	77	1.00000000×10^0
33	35	1.00000000×10^0	74	78	-1.00000000×10^0
32	36	-1.00000000×10^0	81	83	1.00000000×10^0
39	41	1.00000000×10^0	80	84	-1.00000000×10^0
38	42	-1.00000000×10^0	87	89	1.00000000×10^0
45	47	1.00000000×10^0	86	90	-1.00000000×10^0

The input force matrix is

Row	Column	Value	Row	Column	Value
4	1	$-4.06755809 \times 10^{-1}$	16	1	$4.06755809 \times 10^{-1}$
6	1	$9.13536924 \times 10^{-1}$	18	1	$-9.13536924 \times 10^{-1}$

The input force rate matrix is

Row	Column	Value	Row	Column	Value
1	1	0.00000000×10^0	–	–	–

The system is subject to constraints

$$
\begin{bmatrix} \mathbf{J}_h & \mathbf{0} & \mathbf{0} \\ -\mathbf{J}_h\mathbf{V} & \mathbf{J}_h & \mathbf{0} \\ \mathbf{0} & \mathbf{J}_{nh} & \mathbf{0} \end{bmatrix}
\begin{bmatrix} \dot{\boldsymbol{p}} & \boldsymbol{p} \\ \dot{\boldsymbol{w}} & \boldsymbol{w} \\ \dot{\boldsymbol{u}} & \boldsymbol{u} \end{bmatrix}
=
\begin{bmatrix} \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{bmatrix}
$$

Row	Column	Value	Row	Column	Value
8	1	-1.00000000×10^0	64	79	1.00000000×10^0
13	1	-1.00000000×10^0	61	80	1.00000000×10^0
18	1	-1.00000000×10^0	65	80	1.00000000×10^0
24	1	-1.00000000×10^0	62	81	1.00000000×10^0
46	1	-1.00000000×10^0	66	81	1.00000000×10^0
53	1	-1.00000000×10^0	62	82	$-5.62400000 \times 10^{-2}$
60	1	-1.00000000×10^0	63	82	1.00000000×10^0
67	1	-1.00000000×10^0	66	82	$5.62400000 \times 10^{-2}$
9	2	-1.00000000×10^0	62	83	$1.00000000 \times 10^{-1}$
14	2	-1.00000000×10^0	66	83	$-1.00000000 \times 10^{-1}$

19	2	$-1.00000000 \times 10^{0}$	147	83	$-1.00000000 \times 10^{0}$
25	2	$-1.00000000 \times 10^{0}$	151	83	$-1.00000000 \times 10^{0}$
47	2	$-1.00000000 \times 10^{0}$	60	84	$5.62400000 \times 10^{-2}$
54	2	$-1.00000000 \times 10^{0}$	61	84	$-1.00000000 \times 10^{-1}$
61	2	$-1.00000000 \times 10^{0}$	64	84	$-5.62400000 \times 10^{-2}$
68	2	$-1.00000000 \times 10^{0}$	65	84	$1.00000000 \times 10^{-1}$
10	3	$-1.00000000 \times 10^{0}$	146	84	1.00000000×10^{0}
15	3	$-1.00000000 \times 10^{0}$	150	84	1.00000000×10^{0}
20	3	$-1.00000000 \times 10^{0}$	67	85	1.00000000×10^{0}
26	3	$-1.00000000 \times 10^{0}$	71	85	1.00000000×10^{0}
48	3	$-1.00000000 \times 10^{0}$	68	86	1.00000000×10^{0}
55	3	$-1.00000000 \times 10^{0}$	72	86	1.00000000×10^{0}
62	3	$-1.00000000 \times 10^{0}$	69	87	1.00000000×10^{0}
69	3	$-1.00000000 \times 10^{0}$	73	87	1.00000000×10^{0}
9	4	$-1.11600000 \times 10^{-1}$	69	88	$-7.50000000 \times 10^{-2}$
11	4	1.00000000×10^{0}	70	88	1.00000000×10^{0}
14	4	$-2.84600000 \times 10^{-1}$	73	88	$7.50000000 \times 10^{-2}$
16	4	1.00000000×10^{0}	69	89	$1.00000000 \times 10^{-1}$
19	4	$3.71400000 \times 10^{-1}$	73	89	$-1.00000000 \times 10^{-1}$
21	4	$-1.00000000 \times 10^{0}$	154	89	$-1.00000000 \times 10^{0}$
25	4	$2.76600000 \times 10^{-1}$	158	89	$-1.00000000 \times 10^{0}$
28	4	$-9.13536924 \times 10^{-1}$	67	90	$7.50000000 \times 10^{-2}$
47	4	$-2.72400000 \times 10^{-1}$	68	90	$-1.00000000 \times 10^{-1}$
48	4	$-2.12480000 \times 10^{-1}$	71	90	$-7.50000000 \times 10^{-2}$
49	4	$-1.00000000 \times 10^{0}$	72	90	$1.00000000 \times 10^{-1}$
54	4	$-1.72400000 \times 10^{-1}$	153	90	1.00000000×10^{0}
55	4	$-2.50000000 \times 10^{-1}$	157	90	1.00000000×10^{0}
56	4	$-1.00000000 \times 10^{0}$	93	91	$-1.00000000 \times 10^{0}$
61	4	$-2.72400000 \times 10^{-1}$	98	91	$-1.00000000 \times 10^{0}$
62	4	$2.12480000 \times 10^{-1}$	103	91	$-1.00000000 \times 10^{0}$
63	4	$-1.00000000 \times 10^{0}$	109	91	$-1.00000000 \times 10^{0}$
68	4	$-1.72400000 \times 10^{-1}$	131	91	$-1.00000000 \times 10^{0}$
69	4	$2.50000000 \times 10^{-1}$	138	91	$-1.00000000 \times 10^{0}$
70	4	$-1.00000000 \times 10^{0}$	145	91	$-1.00000000 \times 10^{0}$
8	5	$1.11600000 \times 10^{-1}$	152	91	$-1.00000000 \times 10^{0}$
10	5	$-1.28900000 \times 10^{-1}$	94	92	$-1.00000000 \times 10^{0}$
13	5	$2.84600000 \times 10^{-1}$	99	92	$-1.00000000 \times 10^{0}$
15	5	$-1.38900000 \times 10^{-1}$	104	92	$-1.00000000 \times 10^{0}$
18	5	$-3.71400000 \times 10^{-1}$	110	92	$-1.00000000 \times 10^{0}$
20	5	$-3.13900000 \times 10^{-1}$	132	92	$-1.00000000 \times 10^{0}$
22	5	$-1.00000000 \times 10^{0}$	139	92	$-1.00000000 \times 10^{0}$
24	5	$-2.76600000 \times 10^{-1}$	146	92	$-1.00000000 \times 10^{0}$
26	5	$4.95100000 \times 10^{-1}$	153	92	$-1.00000000 \times 10^{0}$
27	5	$-1.00000000 \times 10^{0}$	95	93	$-1.00000000 \times 10^{0}$
46	5	$2.72400000 \times 10^{-1}$	100	93	$-1.00000000 \times 10^{0}$
48	5	$3.62100000 \times 10^{-1}$	105	93	$-1.00000000 \times 10^{0}$
53	5	$1.72400000 \times 10^{-1}$	111	93	$-1.00000000 \times 10^{0}$
55	5	$3.62100000 \times 10^{-1}$	133	93	$-1.00000000 \times 10^{0}$
60	5	$2.72400000 \times 10^{-1}$	140	93	$-1.00000000 \times 10^{0}$
62	5	$3.62100000 \times 10^{-1}$	147	93	$-1.00000000 \times 10^{0}$
67	5	$1.72400000 \times 10^{-1}$	154	93	$-1.00000000 \times 10^{0}$
69	5	$3.62100000 \times 10^{-1}$	94	94	$-1.11600000 \times 10^{-1}$
95	5	1.00000000×10^{0}	96	94	1.00000000×10^{0}
100	5	1.00000000×10^{0}	99	94	$-2.84600000 \times 10^{-1}$
105	5	1.00000000×10^{0}	101	94	1.00000000×10^{0}
111	5	1.00000000×10^{0}	104	94	$3.71400000 \times 10^{-1}$
133	5	1.00000000×10^{0}	106	94	$-1.00000000 \times 10^{0}$
140	5	1.00000000×10^{0}	110	94	$2.76600000 \times 10^{-1}$
147	5	1.00000000×10^{0}	113	94	$-9.13536924 \times 10^{-1}$

154	5	1.00000000×10^{0}	132	94	$-2.72400000 \times 10^{-1}$
9	6	$1.28900000 \times 10^{-1}$	133	94	$-2.12480000 \times 10^{-1}$
12	6	$-1.00000000 \times 10^{0}$	134	94	$-1.00000000 \times 10^{0}$
14	6	$1.38900000 \times 10^{-1}$	139	94	$-1.72400000 \times 10^{-1}$
17	6	$-1.00000000 \times 10^{0}$	140	94	$-2.50000000 \times 10^{-1}$
19	6	$3.13900000 \times 10^{-1}$	141	94	$-1.00000000 \times 10^{0}$
23	6	$-1.00000000 \times 10^{0}$	146	94	$-2.72400000 \times 10^{-1}$
25	6	$-4.95100000 \times 10^{-1}$	147	94	$2.12480000 \times 10^{-1}$
28	6	$-4.06755809 \times 10^{-1}$	148	94	$-1.00000000 \times 10^{0}$
46	6	$2.12480000 \times 10^{-1}$	153	94	$-1.72400000 \times 10^{-1}$
47	6	$-3.62100000 \times 10^{-1}$	154	94	$2.50000000 \times 10^{-1}$
53	6	$2.50000000 \times 10^{-1}$	155	94	$-1.00000000 \times 10^{0}$
54	6	$-3.62100000 \times 10^{-1}$	93	95	$1.11600000 \times 10^{-1}$
60	6	$-2.12480000 \times 10^{-1}$	95	95	$-1.28900000 \times 10^{-1}$
61	6	$-3.62100000 \times 10^{-1}$	98	95	$2.84600000 \times 10^{-1}$
67	6	$-2.50000000 \times 10^{-1}$	100	95	$-1.38900000 \times 10^{-1}$
68	6	$-3.62100000 \times 10^{-1}$	103	95	$-3.71400000 \times 10^{-1}$
94	6	$-1.00000000 \times 10^{0}$	105	95	$-3.13900000 \times 10^{-1}$
99	6	$-1.00000000 \times 10^{0}$	107	95	$-1.00000000 \times 10^{0}$
104	6	$-1.00000000 \times 10^{0}$	109	95	$-2.76600000 \times 10^{-1}$
110	6	$-1.00000000 \times 10^{0}$	111	95	$4.95100000 \times 10^{-1}$
132	6	$-1.00000000 \times 10^{0}$	112	95	$-1.00000000 \times 10^{0}$
139	6	$-1.00000000 \times 10^{0}$	131	95	$2.72400000 \times 10^{-1}$
146	6	$-1.00000000 \times 10^{0}$	133	95	$3.62100000 \times 10^{-1}$
153	6	$-1.00000000 \times 10^{0}$	138	95	$1.72400000 \times 10^{-1}$
18	7	1.00000000×10^{0}	140	95	$3.62100000 \times 10^{-1}$
19	8	1.00000000×10^{0}	145	95	$2.72400000 \times 10^{-1}$
20	9	1.00000000×10^{0}	147	95	$3.62100000 \times 10^{-1}$
19	10	$2.96200000 \times 10^{-1}$	152	95	$1.72400000 \times 10^{-1}$
21	10	1.00000000×10^{0}	154	95	$3.62100000 \times 10^{-1}$
18	11	$-2.96200000 \times 10^{-1}$	94	96	$1.28900000 \times 10^{-1}$
20	11	$5.10000000 \times 10^{-2}$	97	96	$-1.00000000 \times 10^{0}$
22	11	1.00000000×10^{0}	99	96	$1.38900000 \times 10^{-1}$
105	11	$-1.00000000 \times 10^{0}$	102	96	$-1.00000000 \times 10^{0}$
19	12	$-5.10000000 \times 10^{-2}$	104	96	$3.13900000 \times 10^{-1}$
23	12	1.00000000×10^{0}	108	96	$-1.00000000 \times 10^{0}$
104	12	1.00000000×10^{0}	110	96	$-4.95100000 \times 10^{-1}$
24	13	1.00000000×10^{0}	113	96	$-4.06755809 \times 10^{-1}$
25	14	1.00000000×10^{0}	131	96	$2.12480000 \times 10^{-1}$
26	15	1.00000000×10^{0}	132	96	$-3.62100000 \times 10^{-1}$
2	16	$4.54923538 \times 10^{-1}$	138	96	$2.50000000 \times 10^{-1}$
25	16	$2.10000000 \times 10^{-2}$	139	96	$-3.62100000 \times 10^{-1}$
28	16	$9.13536924 \times 10^{-1}$	145	96	$-2.12480000 \times 10^{-1}$
24	17	$-2.10000000 \times 10^{-2}$	146	96	$-3.62100000 \times 10^{-1}$
26	17	$-9.00000000 \times 10^{-3}$	152	96	$-2.50000000 \times 10^{-1}$
27	17	1.00000000×10^{0}	153	96	$-3.62100000 \times 10^{-1}$
111	17	$-1.00000000 \times 10^{0}$	103	97	1.00000000×10^{0}
2	18	$-8.90530502 \times 10^{-1}$	104	98	1.00000000×10^{0}
25	18	$9.00000000 \times 10^{-3}$	105	99	1.00000000×10^{0}
28	18	$4.06755809 \times 10^{-1}$	104	100	$2.96200000 \times 10^{-1}$
110	18	1.00000000×10^{0}	106	100	1.00000000×10^{0}
29	19	1.00000000×10^{0}	103	101	$-2.96200000 \times 10^{-1}$
74	19	$-1.00000000 \times 10^{0}$	105	101	$5.10000000 \times 10^{-2}$
80	19	$-1.00000000 \times 10^{0}$	107	101	1.00000000×10^{0}
30	20	1.00000000×10^{0}	104	102	$-5.10000000 \times 10^{-2}$
75	20	$-1.00000000 \times 10^{0}$	108	102	1.00000000×10^{0}
81	20	$-1.00000000 \times 10^{0}$	109	103	1.00000000×10^{0}
31	21	1.00000000×10^{0}	110	104	1.00000000×10^{0}
76	21	$-1.00000000 \times 10^{0}$	111	105	1.00000000×10^{0}

82	21	$-1.00000000 \times 10^{0}$	87	106	$4.54923538 \times 10^{-1}$
30	22	$4.20000000 \times 10^{-2}$	110	106	$2.10000000 \times 10^{-2}$
32	22	$-1.00000000 \times 10^{0}$	113	106	$9.13536924 \times 10^{-1}$
75	22	$-4.20000000 \times 10^{-2}$	109	107	$-2.10000000 \times 10^{-2}$
77	22	$-1.00000000 \times 10^{0}$	111	107	$-9.00000000 \times 10^{-3}$
81	22	$-4.20000000 \times 10^{-2}$	112	107	1.00000000×10^{0}
83	22	$-1.00000000 \times 10^{0}$	87	108	$-8.90530502 \times 10^{-1}$
29	23	$-4.20000000 \times 10^{-2}$	110	108	$9.00000000 \times 10^{-3}$
31	23	$-4.50000000 \times 10^{-2}$	113	108	$4.06755809 \times 10^{-1}$
74	23	$4.20000000 \times 10^{-2}$	114	109	1.00000000×10^{0}
76	23	$4.50000000 \times 10^{-2}$	159	109	$-1.00000000 \times 10^{0}$
78	23	$-1.00000000 \times 10^{0}$	165	109	$-1.00000000 \times 10^{0}$
80	23	$4.20000000 \times 10^{-2}$	115	110	1.00000000×10^{0}
82	23	$4.50000000 \times 10^{-2}$	160	110	$-1.00000000 \times 10^{0}$
84	23	$-1.00000000 \times 10^{0}$	166	110	$-1.00000000 \times 10^{0}$
116	23	$-1.00000000 \times 10^{0}$	116	111	1.00000000×10^{0}
161	23	1.00000000×10^{0}	161	111	$-1.00000000 \times 10^{0}$
167	23	1.00000000×10^{0}	167	111	$-1.00000000 \times 10^{0}$
30	24	$4.50000000 \times 10^{-2}$	115	112	$4.20000000 \times 10^{-2}$
33	24	1.00000000×10^{0}	117	112	$-1.00000000 \times 10^{0}$
75	24	$-4.50000000 \times 10^{-2}$	160	112	$-4.20000000 \times 10^{-2}$
79	24	$-1.00000000 \times 10^{0}$	162	112	$-1.00000000 \times 10^{0}$
81	24	$-4.50000000 \times 10^{-2}$	166	112	$-4.20000000 \times 10^{-2}$
85	24	$-1.00000000 \times 10^{0}$	168	112	$-1.00000000 \times 10^{0}$
115	24	1.00000000×10^{0}	114	113	$-4.20000000 \times 10^{-2}$
160	24	$-1.00000000 \times 10^{0}$	116	113	$-4.50000000 \times 10^{-2}$
166	24	$-1.00000000 \times 10^{0}$	159	113	$4.20000000 \times 10^{-2}$
1	25	$7.06529316 \times 10^{-1}$	161	113	$4.50000000 \times 10^{-2}$
3	25	1.00000000×10^{0}	163	113	$-1.00000000 \times 10^{0}$
8	25	1.00000000×10^{0}	165	113	$4.20000000 \times 10^{-2}$
4	26	1.00000000×10^{0}	167	113	$4.50000000 \times 10^{-2}$
9	26	1.00000000×10^{0}	169	113	$-1.00000000 \times 10^{0}$
1	27	$-7.07683775 \times 10^{-1}$	115	114	$4.50000000 \times 10^{-2}$
5	27	1.00000000×10^{0}	118	114	1.00000000×10^{0}
10	27	1.00000000×10^{0}	160	114	$-4.50000000 \times 10^{-2}$
4	28	$1.43000000 \times 10^{-2}$	164	114	$-1.00000000 \times 10^{0}$
6	28	$-1.00000000 \times 10^{0}$	166	114	$-4.50000000 \times 10^{-2}$
9	28	$-4.95000000 \times 10^{-2}$	170	114	$-1.00000000 \times 10^{0}$
11	28	$-1.00000000 \times 10^{0}$	86	115	$7.06529316 \times 10^{-1}$
1	29	$9.89055612 \times 10^{-2}$	88	115	1.00000000×10^{0}
3	29	$-1.43000000 \times 10^{-2}$	93	115	1.00000000×10^{0}
5	29	$1.96000000 \times 10^{-1}$	89	116	1.00000000×10^{0}
8	29	$4.95000000 \times 10^{-2}$	94	116	1.00000000×10^{0}
10	29	$-3.53000000 \times 10^{-1}$	86	117	$-7.07683775 \times 10^{-1}$
86	29	$7.07683775 \times 10^{-1}$	90	117	1.00000000×10^{0}
90	29	$-1.00000000 \times 10^{0}$	95	117	1.00000000×10^{0}
95	29	$-1.00000000 \times 10^{0}$	89	118	$1.43000000 \times 10^{-2}$
4	30	$-1.96000000 \times 10^{-1}$	91	118	$-1.00000000 \times 10^{0}$
7	30	1.00000000×10^{0}	94	118	$-4.95000000 \times 10^{-2}$
9	30	$3.53000000 \times 10^{-1}$	96	118	$-1.00000000 \times 10^{0}$
12	30	1.00000000×10^{0}	86	119	$9.89055612 \times 10^{-2}$
89	30	1.00000000×10^{0}	88	119	$-1.43000000 \times 10^{-2}$
94	30	1.00000000×10^{0}	90	119	$1.96000000 \times 10^{-1}$
1	31	$-7.06529316 \times 10^{-1}$	93	119	$4.95000000 \times 10^{-2}$
13	31	1.00000000×10^{0}	95	119	$-3.53000000 \times 10^{-1}$
14	32	1.00000000×10^{0}	89	120	$-1.96000000 \times 10^{-1}$
1	33	$7.07683775 \times 10^{-1}$	92	120	1.00000000×10^{0}
15	33	1.00000000×10^{0}	94	120	$3.53000000 \times 10^{-1}$
14	34	$-1.50666667 \times 10^{-2}$	97	120	1.00000000×10^{0}

16	34	$-1.00000000 \times 10^{0}$	86	121	$-7.06529316 \times 10^{-1}$
1	35	$1.31156239 \times 10^{-2}$	98	121	1.00000000×10^{0}
13	35	$1.50666667 \times 10^{-2}$	99	122	1.00000000×10^{0}
15	35	$-4.63666667 \times 10^{-2}$	86	123	$7.07683775 \times 10^{-1}$
86	35	$-7.07683775 \times 10^{-1}$	100	123	1.00000000×10^{0}
100	35	$-1.00000000 \times 10^{0}$	99	124	$-1.50666667 \times 10^{-2}$
14	36	$4.63666667 \times 10^{-2}$	101	124	$-1.00000000 \times 10^{0}$
17	36	1.00000000×10^{0}	86	125	$1.31156239 \times 10^{-2}$
99	36	1.00000000×10^{0}	98	125	$1.50666667 \times 10^{-2}$
29	37	$-1.00000000 \times 10^{0}$	100	125	$-4.63666667 \times 10^{-2}$
30	38	$-1.00000000 \times 10^{0}$	99	126	$4.63666667 \times 10^{-2}$
31	39	$-1.00000000 \times 10^{0}$	102	126	1.00000000×10^{0}
32	40	1.00000000×10^{0}	114	127	$-1.00000000 \times 10^{0}$
116	41	1.00000000×10^{0}	115	128	$-1.00000000 \times 10^{0}$
33	42	$-1.00000000 \times 10^{0}$	116	129	$-1.00000000 \times 10^{0}$
115	42	$-1.00000000 \times 10^{0}$	117	130	1.00000000×10^{0}
3	43	$-1.00000000 \times 10^{0}$	118	132	$-1.00000000 \times 10^{0}$
4	44	$-1.00000000 \times 10^{0}$	88	133	$-1.00000000 \times 10^{0}$
5	45	$-1.00000000 \times 10^{0}$	89	134	$-1.00000000 \times 10^{0}$
6	46	1.00000000×10^{0}	90	135	$-1.00000000 \times 10^{0}$
90	47	1.00000000×10^{0}	91	136	1.00000000×10^{0}
7	48	$-1.00000000 \times 10^{0}$	92	138	$-1.00000000 \times 10^{0}$
89	48	$-1.00000000 \times 10^{0}$	119	139	$-1.00000000 \times 10^{0}$
34	49	$-1.00000000 \times 10^{0}$	125	139	$-1.00000000 \times 10^{0}$
40	49	$-1.00000000 \times 10^{0}$	120	140	$-1.00000000 \times 10^{0}$
35	50	$-1.00000000 \times 10^{0}$	126	140	$-1.00000000 \times 10^{0}$
41	50	$-1.00000000 \times 10^{0}$	121	141	$-1.00000000 \times 10^{0}$
36	51	$-1.00000000 \times 10^{0}$	127	141	$-1.00000000 \times 10^{0}$
42	51	$-1.00000000 \times 10^{0}$	87	142	$-4.54923538 \times 10^{-1}$
2	52	$-4.54923538 \times 10^{-1}$	121	142	$-1.00000000 \times 10^{-1}$
36	52	$-1.00000000 \times 10^{-1}$	122	142	$-1.00000000 \times 10^{0}$
37	52	$-1.00000000 \times 10^{0}$	127	142	$1.00000000 \times 10^{-1}$
42	52	$1.00000000 \times 10^{-1}$	128	142	$-1.00000000 \times 10^{0}$
43	52	$-1.00000000 \times 10^{0}$	123	143	$-1.00000000 \times 10^{0}$
38	53	$-1.00000000 \times 10^{0}$	129	143	$-1.00000000 \times 10^{0}$
44	53	$-1.00000000 \times 10^{0}$	87	144	$8.90530502 \times 10^{-1}$
121	53	1.00000000×10^{0}	119	144	$1.00000000 \times 10^{-1}$
127	53	1.00000000×10^{0}	124	144	$-1.00000000 \times 10^{0}$
2	54	$8.90530502 \times 10^{-1}$	125	144	$-1.00000000 \times 10^{-1}$
34	54	$1.00000000 \times 10^{-1}$	130	144	$-1.00000000 \times 10^{0}$
39	54	$-1.00000000 \times 10^{0}$	119	145	1.00000000×10^{0}
40	54	$-1.00000000 \times 10^{-1}$	135	145	$-1.00000000 \times 10^{0}$
45	54	$-1.00000000 \times 10^{0}$	142	145	$-1.00000000 \times 10^{0}$
120	54	$-1.00000000 \times 10^{0}$	165	145	1.00000000×10^{0}
126	54	$-1.00000000 \times 10^{0}$	120	146	1.00000000×10^{0}
34	55	1.00000000×10^{0}	136	146	$-1.00000000 \times 10^{0}$
50	55	$-1.00000000 \times 10^{0}$	143	146	$-1.00000000 \times 10^{0}$
57	55	$-1.00000000 \times 10^{0}$	166	146	1.00000000×10^{0}
80	55	1.00000000×10^{0}	121	147	1.00000000×10^{0}
35	56	1.00000000×10^{0}	137	147	$-1.00000000 \times 10^{0}$
51	56	$-1.00000000 \times 10^{0}$	144	147	$-1.00000000 \times 10^{0}$
58	56	$-1.00000000 \times 10^{0}$	167	147	1.00000000×10^{0}
81	56	1.00000000×10^{0}	120	148	$-2.68480308 \times 10^{-1}$
36	57	1.00000000×10^{0}	122	148	1.00000000×10^{0}
52	57	$-1.00000000 \times 10^{0}$	136	148	$-8.20000000 \times 10^{-2}$
59	57	$-1.00000000 \times 10^{0}$	143	148	$1.80000000 \times 10^{-2}$
82	57	1.00000000×10^{0}	167	148	$-1.00000000 \times 10^{-1}$
35	58	$-2.68480308 \times 10^{-1}$	168	148	1.00000000×10^{0}
37	58	1.00000000×10^{0}	119	149	$2.68480308 \times 10^{-1}$

51	58	$-8.20000000 \times 10^{-2}$	121	149	$1.33859344 \times 10^{-1}$
58	58	$1.80000000 \times 10^{-2}$	123	149	1.00000000×10^{0}
82	58	$-1.00000000 \times 10^{-1}$	135	149	$8.20000000 \times 10^{-2}$
83	58	1.00000000×10^{0}	137	149	$-1.70000000 \times 10^{-1}$
34	59	$2.68480308 \times 10^{-1}$	142	149	$-1.80000000 \times 10^{-2}$
36	59	$1.33859344 \times 10^{-1}$	144	149	$-1.70000000 \times 10^{-1}$
38	59	1.00000000×10^{0}	169	149	1.00000000×10^{0}
50	59	$8.20000000 \times 10^{-2}$	120	150	$-1.33859344 \times 10^{-1}$
52	59	$-1.70000000 \times 10^{-1}$	124	150	1.00000000×10^{0}
57	59	$-1.80000000 \times 10^{-2}$	136	150	$1.70000000 \times 10^{-1}$
59	59	$-1.70000000 \times 10^{-1}$	143	150	$1.70000000 \times 10^{-1}$
84	59	1.00000000×10^{0}	165	150	$1.00000000 \times 10^{-1}$
121	59	$-1.00000000 \times 10^{0}$	170	150	1.00000000×10^{0}
137	59	1.00000000×10^{0}	125	151	1.00000000×10^{0}
144	59	1.00000000×10^{0}	149	151	$-1.00000000 \times 10^{0}$
167	59	$-1.00000000 \times 10^{0}$	156	151	$-1.00000000 \times 10^{0}$
35	60	$-1.33859344 \times 10^{-1}$	159	151	1.00000000×10^{0}
39	60	1.00000000×10^{0}	126	152	1.00000000×10^{0}
51	60	$1.70000000 \times 10^{-1}$	150	152	$-1.00000000 \times 10^{0}$
58	60	$1.70000000 \times 10^{-1}$	157	152	$-1.00000000 \times 10^{0}$
80	60	$1.00000000 \times 10^{-1}$	160	152	1.00000000×10^{0}
85	60	1.00000000×10^{0}	127	153	1.00000000×10^{0}
120	60	1.00000000×10^{0}	151	153	$-1.00000000 \times 10^{0}$
136	60	$-1.00000000 \times 10^{0}$	158	153	$-1.00000000 \times 10^{0}$
143	60	$-1.00000000 \times 10^{0}$	161	153	1.00000000×10^{0}
166	60	1.00000000×10^{0}	126	154	$-2.68480308 \times 10^{-1}$
40	61	1.00000000×10^{0}	128	154	1.00000000×10^{0}
64	61	$-1.00000000 \times 10^{0}$	150	154	$-8.20000000 \times 10^{-2}$
71	61	$-1.00000000 \times 10^{0}$	157	154	$1.80000000 \times 10^{-2}$
74	61	1.00000000×10^{0}	161	154	$1.00000000 \times 10^{-1}$
41	62	1.00000000×10^{0}	162	154	1.00000000×10^{0}
65	62	$-1.00000000 \times 10^{0}$	125	155	$2.68480308 \times 10^{-1}$
72	62	$-1.00000000 \times 10^{0}$	127	155	$1.33859344 \times 10^{-1}$
75	62	1.00000000×10^{0}	129	155	1.00000000×10^{0}
42	63	1.00000000×10^{0}	149	155	$8.20000000 \times 10^{-2}$
66	63	$-1.00000000 \times 10^{0}$	151	155	$-1.70000000 \times 10^{-1}$
73	63	$-1.00000000 \times 10^{0}$	156	155	$-1.80000000 \times 10^{-2}$
76	63	1.00000000×10^{0}	158	155	$-1.70000000 \times 10^{-1}$
41	64	$-2.68480308 \times 10^{-1}$	163	155	1.00000000×10^{0}
43	64	1.00000000×10^{0}	126	156	$-1.33859344 \times 10^{-1}$
65	64	$-8.20000000 \times 10^{-2}$	130	156	1.00000000×10^{0}
72	64	$1.80000000 \times 10^{-2}$	150	156	$1.70000000 \times 10^{-1}$
76	64	$1.00000000 \times 10^{-1}$	157	156	$1.70000000 \times 10^{-1}$
77	64	1.00000000×10^{0}	159	156	$-1.00000000 \times 10^{-1}$
40	65	$2.68480308 \times 10^{-1}$	164	156	1.00000000×10^{0}
42	65	$1.33859344 \times 10^{-1}$	131	157	1.00000000×10^{0}
44	65	1.00000000×10^{0}	135	157	1.00000000×10^{0}
64	65	$8.20000000 \times 10^{-2}$	132	158	1.00000000×10^{0}
66	65	$-1.70000000 \times 10^{-1}$	136	158	1.00000000×10^{0}
71	65	$-1.80000000 \times 10^{-2}$	133	159	1.00000000×10^{0}
73	65	$-1.70000000 \times 10^{-1}$	137	159	1.00000000×10^{0}
78	65	1.00000000×10^{0}	133	160	$5.62400000 \times 10^{-2}$
127	65	$-1.00000000 \times 10^{0}$	134	160	1.00000000×10^{0}
151	65	1.00000000×10^{0}	137	160	$-5.62400000 \times 10^{-2}$
158	65	1.00000000×10^{0}	133	161	$1.00000000 \times 10^{-1}$
161	65	$-1.00000000 \times 10^{0}$	137	161	$-1.00000000 \times 10^{-1}$
41	66	$-1.33859344 \times 10^{-1}$	131	162	$-5.62400000 \times 10^{-2}$
45	66	1.00000000×10^{0}	132	162	$-1.00000000 \times 10^{-1}$
65	66	$1.70000000 \times 10^{-1}$	135	162	$5.62400000 \times 10^{-2}$

72	66	$1.70000000 \times 10^{-1}$	136	162	$1.00000000 \times 10^{-1}$
74	66	$-1.00000000 \times 10^{-1}$	138	163	1.00000000×10^{0}
79	66	1.00000000×10^{0}	142	163	1.00000000×10^{0}
126	66	1.00000000×10^{0}	139	164	1.00000000×10^{0}
150	66	$-1.00000000 \times 10^{0}$	143	164	1.00000000×10^{0}
157	66	$-1.00000000 \times 10^{0}$	140	165	1.00000000×10^{0}
160	66	1.00000000×10^{0}	144	165	1.00000000×10^{0}
46	67	1.00000000×10^{0}	140	166	$7.50000000 \times 10^{-2}$
50	67	1.00000000×10^{0}	141	166	1.00000000×10^{0}
47	68	1.00000000×10^{0}	144	166	$-7.50000000 \times 10^{-2}$
51	68	1.00000000×10^{0}	140	167	$1.00000000 \times 10^{-1}$
48	69	1.00000000×10^{0}	144	167	$-1.00000000 \times 10^{-1}$
52	69	1.00000000×10^{0}	138	168	$-7.50000000 \times 10^{-2}$
48	70	$5.62400000 \times 10^{-2}$	139	168	$-1.00000000 \times 10^{-1}$
49	70	1.00000000×10^{0}	142	168	$7.50000000 \times 10^{-2}$
52	70	$-5.62400000 \times 10^{-2}$	143	168	$1.00000000 \times 10^{-1}$
48	71	$1.00000000 \times 10^{-1}$	145	169	1.00000000×10^{0}
52	71	$-1.00000000 \times 10^{-1}$	149	169	1.00000000×10^{0}
133	71	$-1.00000000 \times 10^{0}$	146	170	1.00000000×10^{0}
137	71	$-1.00000000 \times 10^{0}$	150	170	1.00000000×10^{0}
46	72	$-5.62400000 \times 10^{-2}$	147	171	1.00000000×10^{0}
47	72	$-1.00000000 \times 10^{-1}$	151	171	1.00000000×10^{0}
50	72	$5.62400000 \times 10^{-2}$	147	172	$-5.62400000 \times 10^{-2}$
51	72	$1.00000000 \times 10^{-1}$	148	172	1.00000000×10^{0}
132	72	1.00000000×10^{0}	151	172	$5.62400000 \times 10^{-2}$
136	72	1.00000000×10^{0}	147	173	$1.00000000 \times 10^{-1}$
53	73	1.00000000×10^{0}	151	173	$-1.00000000 \times 10^{-1}$
57	73	1.00000000×10^{0}	145	174	$5.62400000 \times 10^{-2}$
54	74	1.00000000×10^{0}	146	174	$-1.00000000 \times 10^{-1}$
58	74	1.00000000×10^{0}	149	174	$-5.62400000 \times 10^{-2}$
55	75	1.00000000×10^{0}	150	174	$1.00000000 \times 10^{-1}$
59	75	1.00000000×10^{0}	152	175	1.00000000×10^{0}
55	76	$7.50000000 \times 10^{-2}$	156	175	1.00000000×10^{0}
56	76	1.00000000×10^{0}	153	176	1.00000000×10^{0}
59	76	$-7.50000000 \times 10^{-2}$	157	176	1.00000000×10^{0}
55	77	$1.00000000 \times 10^{-1}$	154	177	1.00000000×10^{0}
59	77	$-1.00000000 \times 10^{-1}$	158	177	1.00000000×10^{0}
140	77	$-1.00000000 \times 10^{0}$	154	178	$-7.50000000 \times 10^{-2}$
144	77	$-1.00000000 \times 10^{0}$	155	178	1.00000000×10^{0}
53	78	$-7.50000000 \times 10^{-2}$	158	178	$7.50000000 \times 10^{-2}$
54	78	$-1.00000000 \times 10^{-1}$	154	179	$1.00000000 \times 10^{-1}$
57	78	$7.50000000 \times 10^{-2}$	158	179	$-1.00000000 \times 10^{-1}$
58	78	$1.00000000 \times 10^{-1}$	152	180	$7.50000000 \times 10^{-2}$
139	78	1.00000000×10^{0}	153	180	$-1.00000000 \times 10^{-1}$
143	78	1.00000000×10^{0}	156	180	$-7.50000000 \times 10^{-2}$
60	79	1.00000000×10^{0}	157	180	$1.00000000 \times 10^{-1}$

The full state space equations:

$$\begin{bmatrix} \mathbf{E} & \mathbf{0} \\ \mathbf{0} & \mathbf{I} \end{bmatrix} \begin{Bmatrix} \dot{x} \\ y \end{Bmatrix} = \begin{bmatrix} \mathbf{A} & \mathbf{B} \\ \mathbf{C} & \mathbf{D} \end{bmatrix} \begin{Bmatrix} x \\ u \end{Bmatrix}$$

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \left[\begin{array}{ccccccc} 1.14101179\times10^{3} & -2.33844587\times10^{3} & -1.16690755\times10^{3} & 9.63611219\times10^{2} & 9.34380710\times10^{0} & -2.87057770\times10^{2} & -5.29540335\times10^{2} \\ 1.44728677\times10^{-1} & 2.94980319\times10^{-3} & -2.43161117\times10^{-1} & -1.28279759\times10^{-1} & 1.10350461\times10^{-2} & -1.24320264\times10^{-1} & 2.59630353\times10^{-1} \\ -6.30005126\times10^{-3} & -3.39530282\times10^{-1} & 2.55750088\times10^{-1} & 1.23816095\times10^{-1} & -2.24926651\times10^{-1} & -1.50366612\times10^{-1} & 4.16260006\times10^{-2} \\ 2.14480003\times10^{3} & -3.17246001\times10^{3} & -1.62813455\times10^{3} & -5.64605575\times10^{2} & -1.59669014\times10^{3} & -8.70783569\times10^{2} & 2.23043022\times10^{3} \\ -1.25208830\times10^{-1} & -1.40354416\times10^{-1} & 3.23215671\times10^{-2} & 3.59197441\times10^{-1} & 2.23431976\times10^{-1} & 2.31969283\times10^{-1} & 1.80493897\times10^{-1} \\ 1.46522407\times10^{3} & 1.38959612\times10^{3} & 1.78841912\times10^{2} & 1.77001248\times10^{3} & 1.42692229\times10^{2} & 5.77752044\times10^{2} & -1.15309332\times10^{3} \\ 8.26269015\times10^{-2} & 2.26017507\times10^{-2} & -1.15561098\times10^{-1} & -3.88582185\times10^{-2} & -1.99618467\times10^{-1} & 8.25557266\times10^{-2} & -4.10817821\times10^{-1} \\ -1.51827612\times10^{3} & 7.39845413\times10^{2} & 2.58617532\times10^{2} & -1.06601583\times10^{3} & 4.69906553\times10^{2} & 3.65461957\times10^{2} & 8.94969142\times10^{2} \\ 4.14365721\times10^{3} & -2.73637713\times10^{3} & -2.08150834\times10^{3} & 9.40468810\times10^{2} & -1.92830730\times10^{3} & -7.32069595\times10^{2} & 1.23087708\times10^{3} \\ -2.52383884\times10^{-1} & 1.20475037\times10^{-1} & -9.59526070\times10^{-2} & -3.15143895\times10^{-1} & -3.68069698\times10^{-1} & 1.41834520\times10^{-1} & 4.29760363\times10^{-1} \\ -2.10672006\times10^{3} & 3.53581290\times10^{3} & 1.76561416\times10^{2} & -6.07259920\times10^{2} & -1.37766318\times10^{2} & -4.59189006\times10^{2} & -6.79584115\times10^{2} \\ -4.73203263\times10^{-4} & -1.08475133\times10^{-1} & -1.04136894\times10^{-1} & -1.53511365\times10^{-1} & -5.10710282\times10^{-2} & 1.18550860\times10^{-1} & 4.07329599\times10^{-1} \\ -7.44197349\times10^{2} & 1.25623112\times10^{2} & 4.62845837\times10^{2} & -1.59202089\times10^{1} & 5.60512579\times10^{2} & 1.09666904\times10^{2} & -4.46689513\times10^{2} \\ 4.02079611\times10^{2} & 3.68776640\times10^{2} & -2.02483680\times10^{3} & -2.48853312\times10^{2} & -7.88689443\times10^{2} & -8.27836907\times10^{2} & 8.48014893\times10^{2} \\ 3.31394040\times10^{3} & -4.64102409\times10^{3} & -6.47260002\times10^{2} & 1.24606796\times10^{3} & -9.51881675\times10^{2} & 9.98366974\times10^{0} & 1.95869323\times10^{2} \\ -2.19984149\times10^{3} & 2.83144452\times10^{3} & 6.65135969\times10^{2} & -1.28430100\times10^{3} & -6.59881533\times10^{1} & 1.23655653\times10^{2} & 1.22535029\times10^{2} \\ 3.25426027\times10^{3} & -5.35676826\times10^{3} & 5.21486960\times10^{2} & -1.08609174\times10^{3} & -8.06549203\times10^{2} & 7.27630873\times10^{2} & 4.21298971\times10^{3} \\ 2.50588237\times10^{3} & -1.80635550\times10^{3} & -7.38767625\times10^{2} & -6.04928241\times10^{2} & -1.25750703\times10^{3} & -5.28024443\times10^{2} & 2.25558080\times10^{3} \\ 1.33040779\times10^{3} & -1.04998623\times10^{3} & -6.45467164\times10^{2} & 2.84851739\times10^{2} & 2.67372469\times10^{2} & 7.97187282\times10^{2} & 7.73240024\times10^{2} \\ -1.70417284\times10^{3} & 5.00175066\times10^{3} & 5.31351871\times10^{2} & 9.24244492\times10^{2} & -2.05723104\times10^{2} & -1.44473682\times10^{2} & -2.48229597\times10^{3} \\ -2.62826450\times10^{3} & 5.50133018\times10^{3} & 2.11270285\times10^{3} & 2.77193566\times10^{2} & 1.77129090\times10^{3} & 1.07679188\times10^{3} & -2.23301904\times10^{3} \\ -3.01887712\times10^{3} & 2.18473564\times10^{3} & 9.94592378\times10^{2} & -1.04483661\times10^{3} & 2.10212058\times10^{3} & 7.83760265\times10^{2} & -3.62070233\times10^{2} \\ 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} \\ \hline -3.81626632\times10^{-2} & 4.87741328\times10^{-3} & 4.38566427\times10^{-2} & -6.62885686\times10^{-2} & -7.91633092\times10^{-2} & -1.47759677\times10^{-2} & -4.18664057\times10^{-2} \\ -1.37621049\times10^{-1} & -1.42514675\times10^{-2} & 5.37405996\times10^{-2} & 4.71057742\times10^{-2} & -4.10125439\times10^{-2} & -6.37464932\times10^{-2} & 4.70279900\times10^{-2} \end{array}\right.$$

$$E = \left[\begin{array}{cccccccc} -4.56944056\times10^{-1} & 1.96800911\times10^{0} & -4.24851239\times10^{-1} & -7.62597431\times10^{-1} & -2.14008491\times10^{0} & -1.35798451\times10^{0} & 2.53543676\times10^{0} & 2.21588\dots \\ -1.41353663\times10^{-1} & -9.52540354\times10^{-3} & 1.07592694\times10^{-1} & 1.45751420\times10^{-1} & -3.14052169\times10^{-1} & 3.61423130\times10^{-4} & 1.30677574\times10^{-1} & 2.02621\dots \\ 3.61954055\times10^{-1} & 3.27751981\times10^{-1} & 3.80486302\times10^{-1} & 2.34895159\times10^{-1} & 1.69735064\times10^{-1} & -6.97139713\times10^{-2} & -2.29210500\times10^{-1} & 8.88850\dots \\ -1.19120992\times10^{-1} & -2.21779318\times10^{0} & 1.71098422\times10^{0} & 8.71741998\times10^{-1} & -5.67985234\times10^{-1} & 4.84138303\times10^{-1} & 1.19610768\times10^{0} & -5.74463\dots \\ 3.63271464\times10^{-1} & 1.31601103\times10^{-1} & -2.67014356\times10^{-1} & 2.35925274\times10^{-1} & -2.91869938\times10^{-1} & 9.58665302\times10^{-2} & 1.11037390\times10^{-1} & -2.18742\dots \\ -2.13865803\times10^{-1} & -6.39139563\times10^{-1} & 3.48410537\times10^{-2} & -8.62219113\times10^{-1} & 1.00003361\times10^{0} & 1.07484806\times10^{0} & -5.87941660\times10^{-1} & -1.16006\dots \\ -2.72373420\times10^{-2} & -1.10905656\times10^{-1} & 1.56489301\times10^{-1} & -4.25001446\times10^{-1} & 1.69109805\times10^{-1} & -8.09546771\times10^{-2} & -1.21450874\times10^{-1} & -2.56711\dots \\ 1.37916841\times10^{-2} & -1.49242877\times10^{0} & 1.86981956\times10^{-1} & 7.18016935\times10^{-1} & 3.20514306\times10^{0} & 4.96741405\times10^{-1} & -2.34503616\times10^{0} & -1.26243\dots \\ -1.25449858\times10^{0} & -3.64031966\times10^{0} & 2.42649288\times10^{0} & 5.84514997\times10^{-1} & -1.71834362\times10^{0} & 6.33012212\times10^{-1} & 2.44819607\times10^{0} & -2.38011\dots \\ 2.87742396\times10^{-1} & 8.52843205\times10^{-2} & -1.34399106\times10^{-1} & -2.74392738\times10^{-1} & 1.69870607\times10^{-1} & -3.55202563\times10^{-1} & -2.05040824\times10^{-1} & 2.78866\dots \\ 7.61835626\times10^{-1} & -1.56648243\times10^{0} & 2.12479803\times10^{-1} & 1.19125331\times10^{0} & 3.32520470\times10^{0} & 1.41631774\times10^{0} & -3.40488346\times10^{0} & -1.78575\dots \\ -4.09123336\times10^{-1} & 2.69804815\times10^{-1} & 2.98475292\times10^{-1} & 2.33433084\times10^{-1} & -5.53455327\times10^{-2} & -9.64246728\times10^{-2} & 3.92162119\times10^{-2} & -3.98149\dots \\ -3.49523545\times10^{-1} & -2.02092511\times10^{0} & 9.12965435\times10^{-1} & 2.22803074\times10^{-1} & 1.72575075\times10^{0} & 9.13047481\times10^{-1} & 8.94084558\times10^{-1} & -2.23356\dots \\ 2.90904802\times10^{-1} & -2.53408923\times10^{0} & 6.58958691\times10^{-1} & 1.57109343\times10^{0} & 1.77589762\times10^{0} & 3.37377972\times10^{-1} & -1.89269421\times10^{0} & -8.13159\dots \\ -8.56874812\times10^{-2} & 2.01652799\times10^{0} & -8.56432518\times10^{-1} & -9.83253054\times10^{-1} & -3.45875216\times10^{0} & -1.36251940\times10^{0} & 2.09976555\times10^{0} & 2.10937\dots \\ 2.86890353\times10^{-1} & -2.41208245\times10^{-2} & -3.42455674\times10^{-1} & 5.60956649\times10^{-1} & 1.59214486\times10^{0} & -2.08713449\times10^{-1} & -1.66546194\times10^{0} & 7.25031\dots \\ 1.24412151\times10^{0} & 3.30070074\times10^{0} & -3.28274519\times10^{0} & 3.99767333\times10^{-2} & -2.59473955\times10^{0} & 6.16298308\times10^{-1} & -5.98202488\times10^{0} & 4.00544\dots \\ 3.00482422\times10^{-1} & -1.53277872\times10^{0} & 3.13457872\times10^{-1} & 1.57421132\times10^{0} & -1.29728423\times10^{0} & 1.27182251\times10^{0} & -3.37176794\times10^{0} & -7.32751\dots \\ -7.02740028\times10^{-1} & -5.00440646\times10^{-1} & 8.07210380\times10^{-1} & -4.42726498\times10^{-1} & -1.13602068\times10^{0} & -2.96267381\times10^{-1} & 5.05205541\times10^{-1} & -5.71779\dots \\ -1.25893658\times10^{0} & -1.64358373\times10^{0} & 1.54073921\times10^{0} & -8.26042876\times10^{-1} & 3.16272821\times10^{0} & 5.00916474\times10^{-1} & 3.61232271\times10^{0} & -2.92921\dots \\ -4.57031581\times10^{-1} & -9.09061501\times10^{-1} & 6.40981160\times10^{-1} & -4.26017139\times10^{-1} & 2.32351051\times10^{0} & 4.07690677\times10^{-1} & 8.07317792\times10^{-1} & -2.25443\dots \\ 6.35405740\times10^{-1} & 1.67932153\times10^{0} & -9.61177305\times10^{-1} & 1.73428876\times10^{-1} & 8.80586027\times10^{-1} & -5.79947041\times10^{-1} & -1.44397497\times10^{0} & 1.06645\dots \\ 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000000\times10^{0} & 0.00000\dots \end{array}\right]$$

The reduced state space equations:

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \left[\begin{array}{ccccccc} -6.62626503\times10^{2} & -4.34590874\times10^{2} & -2.35719217\times10^{2} & -4.88441492\times10^{2} & -2.64355569\times10^{2} & 1.09342442\times10^{2} & 1.85833991\times10^{1} \\ -2.52909831\times10^{2} & 1.77464807\times10^{2} & 2.48339895\times10^{2} & 2.29313336\times10^{2} & 3.13516183\times10^{2} & -3.26724653\times10^{1} & -5.26341173\times10^{1} \\ -3.33690036\times10^{2} & -1.44706766\times10^{3} & -1.33170092\times10^{3} & -1.59708631\times10^{3} & -1.60952110\times10^{3} & 2.79489267\times10^{2} & 6.83145043\times10^{1} \\ -7.08438386\times10^{2} & 1.03791251\times10^{2} & 3.11562112\times10^{2} & 1.00414982\times10^{2} & 4.04062705\times10^{2} & 1.92532496\times10^{1} & -3.47462539\times10^{0} \\ 1.09961414\times10^{2} & -1.61101275\times10^{2} & -4.79680380\times10^{2} & -1.58395177\times10^{2} & -6.26937258\times10^{2} & -3.42350082\times10^{1} & 1.05680401\times10^{1} \\ 1.71805269\times10^{2} & -2.51706911\times10^{1} & -7.49459410\times10^{1} & -2.41770897\times10^{1} & -9.81592919\times10^{1} & -1.67851663\times10^{0} & 1.67716298\times10^{-2} \\ \hline -1.76802699\times10^{-3} & 2.51469613\times10^{-3} & 2.12544964\times10^{-3} & -2.40964337\times10^{-3} & 2.81384490\times10^{-3} & 1.15333091\times10^{-3} & 0.00000000\times10^{0} \\ -3.18772250\times10^{-3} & 2.68990642\times10^{-4} & 1.16070750\times10^{-3} & 5.28601899\times10^{-4} & -3.76107882\times10^{-4} & -5.06428190\times10^{-3} & 0.00000000\times10^{0} \end{array}\right]$$