

Corrigendum

Corrigendum to “Three-dimensional vibrations of thick
spherical shell segments with variable thickness”
[International Journal of Solids and Structures
37 (2000) 4811–4823]

Jae-Hoon Kang ^{a,*}, Arthur W. Leissa ^{b,1}

^a School of Constructional and Environmental System Engineering, Kyongju University, Kyongju, Kyongbook, South Korea

^b Applied Mechanics Program, The Ohio State University, Columbus, OH, USA

The authors are grateful to Professor Moshe Eisenberger of the Technion (Israel Institute of Technology), who sent to them numerical results which differed significantly from those previously published in the above-referenced article. He used two different three-dimensional analyses, the results of which essentially agreed with each other.

There was a mistake in the computer program we used to obtain our previous results. Free vibration frequencies for thick spherical shell segments were presented in three tables. The three corrected tables are presented below. [Table 1](#) demonstrates the upper bound convergence of the Ritz method used. [Tables 2 and 3](#) give frequencies which are exact (to the four digits shown) for a variety of spherical shell segments of constant and linearly varying thickness. The fundamental (lowest) frequency in each case is for mode shapes having two circumferential waves ($n = 2$).

DOI of original article: [10.1016/S0020-7683\(99\)00182-1](https://doi.org/10.1016/S0020-7683(99)00182-1)

* Corresponding author. Present address: Department of Architectural Engineering, Chung-Ang University, 221 Heuksuk-Dong, Dongjak-Ku, Seoul 156-756, South Korea. Fax: +82 2 812 4150.

E-mail address: jhkang@cau.ac.kr (J.-H. Kang).

¹ Present address: Department of Mechanical Engineering, Colorado State University, Fort Collins, CO, USA.

Table 1

Convergence of frequencies $\omega a \sqrt{\rho/G}$ of a completely free, spherical shell segment with linearly varying thickness for the five lowest modes of $n = 1$ with $\phi_t = 30^\circ$, $\phi_b = 90^\circ$, $h_m/a = 0.2$, $h_t/h_b = 1/3$, and $\nu = 0.3$

TZ ^a	TP ^b	DET ^c	1	2	3	4	5
2	2	12	0.5975	0.9591	2.629	3.801	6.467
	4	24	0.3656	0.7314	1.881	3.062	3.576
	6	36	0.3638	0.7214	1.874	2.956	3.573
	8	48	0.3637	0.7199	1.873	2.946	3.573
	10	60	0.3636	0.7194	1.873	2.944	3.573
	12	72	0.3636	0.7192	1.873	2.943	3.573
3	2	18	0.5848	0.9545	2.615	3.798	6.441
	4	36	0.3534	0.7209	1.868	2.962	3.575
	6	54	0.3517	0.7108	1.862	2.846	3.572
	8	72	0.3516	0.7095	1.862	2.837	3.572
	10	90	0.3516	0.7091	1.862	2.835	3.572
	12	108	0.3516	0.7090	1.861	2.834	3.572
4	2	24	0.5820	0.9512	2.605	3.797	6.435
	4	48	0.3503	0.7177	1.864	2.941	3.574
	6	72	0.3487	0.7072	1.859	2.819	3.572
	8	96	0.3486	0.7058	1.858	2.811	3.572
	10	120	0.3486	0.7054	1.858	2.810	3.572
	12	144	0.3486	0.7053	1.858	2.810	3.572
5	2	30	0.5814	0.9504	2.600	3.796	6.433
	4	60	0.3503	0.7176	1.864	2.939	3.574
	6	90	0.3486	0.7071	1.859	2.818	3.572
	8	120	0.3485	0.7057	1.858	2.811	3.572
	10	150	0.3485	0.7053	1.858	2.809	3.572
	12	180	0.3485	0.7052	1.857	2.809	3.572
6	2	36	0.5812	0.9497	2.598	3.796	6.433
	4	72	0.3500	0.7166	1.863	2.938	3.574
	6	108	0.3486	0.7069	1.858	2.817	3.572
	8	144	0.3485	0.7056	1.858	2.810	3.572
	10	180	0.3485	0.7053	1.858	2.809	3.572

^a Total number of natural polynomial terms used in the z or ζ direction.

^b Total number of natural polynomial terms used in the ϕ direction.

^c Determinant order.

Table 2

Nondimensional frequencies $\omega a \sqrt{\rho/G}$ of completely free, spherical shell segments with constant thickness ($h_t/h_b = 1$) for $h_m/a = 0.2$ and $\nu = 0.3^a$

n	Mode	(ϕ_t, ϕ_b)				
		(30°, 90°)	(45°, 90°)	(30°, 150°)	(45°, 135°)	(30°, 120°)
0 (T)	1	3.448	4.238	2.083	2.397	2.466
	2	6.241	8.072	3.448	4.238	4.303
	3	9.115	11.96	4.830	6.140	6.192
	4	12.02	15.85	6.241	8.072	8.113
	5	14.92	15.90	7.673	10.02	10.05
0 (A)	1	1.516 (5)	1.537	1.349 (4)	1.526	1.513 (5)
	2	2.210	1.918	1.880	1.916	1.773
	3	2.391	3.258	2.234	1.962	2.273
	4	4.406	6.602	2.310	2.522	2.540
	5	5.667	7.057	2.706	3.948	3.968
1	1	1.558	1.589	1.286 (3)	1.374 (5)	1.388 (4)
	2	2.418	2.437	1.625	1.760	1.801
	3	2.525	3.371	2.092	2.376	2.341
	4	4.425	4.792	2.253	2.639	2.685
	5	4.544	6.678	2.867	3.412	3.550
2	1	0.3241 (1)	0.2953 (1)	0.6433 (1)	0.4058 (1)	0.3573 (1)
	2	0.8397 (3)	0.5871 (2)	0.8034 (2)	0.5671 (2)	0.7672 (2)
	3	1.929	1.909	1.768	1.729	1.752
	4	2.947	3.689	1.852	2.030	2.118
	5	3.605	3.719	2.532	2.969	3.053
3	1	0.8379 (2)	0.7957 (3)	1.443 (5)	1.066 (3)	0.9235 (3)
	2	1.930	1.472 (5)	1.742	1.328 (4)	1.685
	3	2.787	2.626	2.349	2.419	2.567
	4	3.591	4.181	2.773	2.632	2.681
	5	4.653	5.001	3.216	3.471	3.611
4	1	1.475 (4)	1.438 (4)	2.062	1.808	1.601
	2	2.949	2.414	2.591	2.163	2.450
	3	3.794	3.536	3.208	2.988	3.315
	4	4.396	4.789	3.839	3.644	3.669
	5	5.595	5.925	4.162	4.138	4.363
5	1	2.205	2.180	2.703	2.576	2.359
	2	3.891	3.387	3.404	3.064	3.181
	3	4.767	4.527	4.154	3.758	4.155
	4	5.391	5.483	4.905	4.594	4.668
	5	6.665	6.613	5.213	5.015	5.267

^a Note: T, torsional mode; A, axisymmetric mode. Numbers in parentheses identify frequency sequences.

Table 3

Nondimensional frequencies $\omega a \sqrt{\rho/G}$ of completely free, spherical shell segments with linearly varying thickness ($h_t/h_b = 1/3$) for $h_m/a = 0.2$ and $\nu = 0.3^a$

n	Mode	(ϕ_t, ϕ_b)				
		(30°, 90°)	(45°, 90°)	(30°, 150°)	(45°, 135°)	(30°, 120°)
0 (T)	1	3.669	4.475	2.132	2.470	2.580
	2	6.385	8.192	3.492	4.290	4.394
	3	9.200	11.94	4.862	6.172	6.255
	4	11.92	12.29	6.263	8.087	8.154
	5	12.11	15.79	7.685	10.02	10.07
0 (A)	1	1.536 (4)	1.540 (5)	1.371 (5)	1.535	1.556
	2	2.090	1.857	1.874	1.911	1.740
	3	2.423	3.272	2.215	1.963	2.229
	4	4.322	6.474	2.303	2.487	2.500
	5	5.844	7.306	2.643	3.844	3.856
1	1	1.568 (5)	1.592	1.301 (4)	1.390(4)	1.406 (4)
	2	2.374	2.378	1.637	1.771	1.799
	3	2.485	3.360	2.066	2.379	2.321
	4	4.414	4.995	2.273	2.594	2.619
	5	4.572	6.531	2.792	3.445	3.596
2	1	0.3485 (1)	0.3126 (1)	0.5293 (1)	0.3620 (1)	0.4053 (1)
	2	0.7052 (2)	0.5370 (2)	0.8581 (2)	0.6040 (2)	0.6225 (2)
	3	1.857	1.878	1.672	1.690	1.697
	4	2.809	3.629	1.875	2.027	2.034
	5	3.572	3.642	2.468	2.901	2.954
3	1	0.9343 (3)	0.8480 (3)	1.275 (3)	0.9183 (3)	1.060 (3)
	2	1.666	1.348 (4)	1.712	1.400 (5)	1.442 (5)
	3	2.646	2.534	2.275	2.298	2.385
	4	3.346	4.057	2.729	2.651	2.595
	5	4.746	4.961	3.123	3.385	3.458
4	1	1.671	1.541	1.955	1.561	1.820
	2	2.643	2.193	2.415	2.196	2.280
	3	3.564	3.379	3.032	2.911	3.026
	4	4.060	4.610	3.726	3.579	3.518
	5	5.793	6.043	4.088	4.059	4.118
5	1	2.507	2.347	2.606	2.271	2.632
	2	3.637	3.053	3.207	2.954	3.141
	3	4.475	4.296	3.877	3.707	3.848
	4	4.951	5.267	4.639	4.477	4.459
	5	6.665	6.857	5.187	4.952	4.925

^a Note: T, torsional mode; A, axisymmetric mode. Numbers in parentheses identify frequency sequences.