Functionalized AFM probes for force spectroscopy: eigenmodes shape and stiffness calibration through thermal noise measurements

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Supplementary data

Tables I to V report numerical values of $\alpha_n(\tilde{m},\tilde{r})$, for the first 5 modes, $0 \leq \tilde{m} \leq 2$ and $0 \leq \tilde{r} \leq 0.1$.

Mode 1: $\alpha_1(\tilde{m},\tilde{r})$

		$\tilde{r}$										
		0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
$\tilde{m}$	0.00	1.8751	1.8751	1.8751	1.8751	1.8751	1.8751	1.8751	1.8751	1.8751	1.8751	1.8751
	0.10	1.7227	1.7227	1.7226	1.7225	1.7223	1.7221	1.7218	1.7215	1.7211	1.7207	1.7203
	0.20	1.6164	1.6164	1.6162	1.6161	1.6158	1.6155	1.6151	1.6146	1.6140	1.6134	1.6127
	0.30	1.5361	1.5361	1.5360	1.5357	1.5354	1.5350	1.5345	1.5340	1.5333	1.5325	1.5317
	0.40	1.4724	1.4724	1.4722	1.4720	1.4716	1.4712	1.4707	1.4700	1.4693	1.4685	1.4676
	0.50	1.4200	1.4199	1.4198	1.4195	1.4191	1.4187	1.4181	1.4175	1.4167	1.4158	1.4149
	0.60	1.3757	1.3756	1.3755	1.3752	1.3748	1.3744	1.3738	1.3731	1.3723	1.3714	1.3704
	0.70	1.3375	1.3374	1.3373	1.3370	1.3366	1.3362	1.3356	1.3349	1.3341	1.3332	1.3321
	0.80	1.3041	1.3040	1.3039	1.3036	1.3032	1.3027	1.3021	1.3014	1.3006	1.2997	1.2987
	0.90	1.2745	1.2744	1.2742	1.2740	1.2736	1.2731	1.2725	1.2718	1.2710	1.2700	1.2690
	1.00	1.2479	1.2479	1.2477	1.2474	1.2470	1.2465	1.2459	1.2452	1.2444	1.2435	1.2424
	1.10	1.2239	1.2239	1.2237	1.2234	1.2230	1.2225	1.2219	1.2212	1.2204	1.2195	1.2184
	1.20	1.2021	1.2020	1.2018	1.2016	1.2012	1.2007	1.2001	1.1994	1.1986	1.1976	1.1966
	1.30	1.1820	1.1820	1.1818	1.1815	1.1812	1.1807	1.1801	1.1794	1.1785	1.1776	1.1766
	1.40	1.1636	1.1635	1.1633	1.1631	1.1627	1.1622	1.1616	1.1609	1.1601	1.1591	1.1581
	1.50	1.1464	1.1464	1.1462	1.1460	1.1456	1.1451	1.1445	1.1438	1.1430	1.1421	1.1410
	1.60	1.1305	1.1305	1.1303	1.1300	1.1297	1.1292	1.1286	1.1279	1.1271	1.1261	1.1251
	1.70	1.1156	1.1156	1.1154	1.1152	1.1148	1.1143	1.1137	1.1130	1.1122	1.1113	1.1103
	1.80	1.1017	1.1016	1.1015	1.1012	1.1008	1.1003	1.0998	1.0991	1.0983	1.0974	1.0963
	1.90	1.0886	1.0885	1.0884	1.0881	1.0877	1.0872	1.0866	1.0860	1.0852	1.0843	1.0833
	2.00	1.0762	1.0761	1.0760	1.0757	1.0753	1.0749	1.0743	1.0736	1.0728	1.0719	1.0709

TABLE I: $\alpha_1(\tilde{m},\tilde{r})$: table of eigenvalues of mode 1 for $0 \leq \tilde{m} \leq 2$ and $0 \leq \tilde{r} \leq 0.1$.

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Mode 2: $\alpha_2(\tilde{m},\tilde{r})$

		$\tilde{r}$										
		0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
	0.00	4.6941	4.6941	4.6941	4.6941	4.6941	4.6941	4.6941	4.6941	4.6941	4.6941	4.6941
	0.10	4.3995	4.3987	4.3964	4.3925	4.3871	4.3801	4.3715	4.3614	4.3497	4.3363	4.3215
	0.20	4.2671	4.2658	4.2620	4.2556	4.2467	4.2352	4.2211	4.2044	4.1852	4.1635	4.1393
	0.30	4.1923	4.1906	4.1856	4.1772	4.1653	4.1501	4.1315	4.1095	4.0842	4.0557	4.0241
	0.40	4.1444	4.1424	4.1362	4.1259	4.1114	4.0928	4.0701	4.0433	4.0125	3.9779	3.9398
	0.50	4.1111	4.1087	4.1015	4.0894	4.0724	4.0506	4.0239	3.9925	3.9565	3.9163	3.8722
	0.60	4.0867	4.0839	4.0756	4.0618	4.0424	4.0174	3.9869	3.9511	3.9102	3.8646	3.8150
	0.70	4.0679	4.0648	4.0555	4.0400	4.0182	3.9901	3.9559	3.9157	3.8701	3.8194	3.7647
	0.80	4.0531	4.0497	4.0393	4.0221	3.9980	3.9669	3.9290	3.8846	3.8343	3.7788	3.7192
	0.90	4.0411	4.0373	4.0260	4.0071	3.9806	3.9465	3.9049	3.8564	3.8016	3.7416	3.6775
$\tilde{m}$	1.00	4.0311	4.0271	4.0148	3.9942	3.9653	3.9282	3.8831	3.8305	3.7714	3.7070	3.6386
	1.10	4.0228	4.0184	4.0051	3.9829	3.9517	3.9116	3.8629	3.8064	3.7431	3.6745	3.6022
	1.20	4.0157	4.0109	3.9967	3.9728	3.9393	3.8962	3.8440	3.7836	3.7162	3.6437	3.5677
	1.30	4.0096	4.0045	3.9892	3.9637	3.9278	3.8818	3.8262	3.7619	3.6907	3.6144	3.5350
	1.40	4.0042	3.9988	3.9826	3.9554	3.9172	3.8683	3.8092	3.7412	3.6662	3.5863	3.5038
	1.50	3.9995	3.9938	3.9766	3.9477	3.9073	3.8554	3.7929	3.7213	3.6427	3.5594	3.4740
	1.60	3.9954	3.9893	3.9711	3.9406	3.8978	3.8430	3.7772	3.7021	3.6200	3.5335	3.4454
	1.70	3.9916	3.9853	3.9661	3.9340	3.8889	3.8312	3.7620	3.6834	3.5980	3.5086	3.4179
	1.80	3.9883	3.9816	3.9615	3.9277	3.8803	3.8197	3.7473	3.6653	3.5767	3.4845	3.3915
	1.90	3.9853	3.9783	3.9572	3.9217	3.8720	3.8086	3.7330	3.6477	3.5560	3.4611	3.3660
	2.00	3.9826	3.9752	3.9531	3.9161	3.8640	3.7978	3.7190	3.6306	3.5359	3.4385	3.3414

TABLE II: $\alpha_2(\tilde{m},\tilde{r})$: table of eigenvalues of mode 2 for $0 \leq \tilde{m} \leq 2$ and $0 \leq \tilde{r} \leq 0.1$.

Mode 3: $\alpha_3(\tilde{m},\tilde{r})$

		$\tilde{r}$										
		0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
	0.00	7.8548	7.8548	7.8548	7.8548	7.8548	7.8548	7.8548	7.8548	7.8548	7.8548	7.8548
	0.10	7.4511	7.4477	7.4374	7.4201	7.3956	7.3635	7.3237	7.2759	7.2202	7.1568	7.0866
	0.20	7.3184	7.3127	7.2956	7.2666	7.2252	7.1708	7.1032	7.0230	6.9315	6.8310	6.7248
	0.30	7.2537	7.2460	7.2228	7.1833	7.1265	7.0518	6.9595	6.8518	6.7324	6.6066	6.4796
	0.40	7.2155	7.2059	7.1769	7.1271	7.0553	6.9609	6.8456	6.7139	6.5727	6.4296	6.2910
	0.50	7.1903	7.1789	7.1441	7.0842	6.9974	6.8837	6.7469	6.5946	6.4368	6.2826	6.1383
	0.60	7.1725	7.1593	7.1187	7.0485	6.9468	6.8144	6.6577	6.4882	6.3183	6.1575	6.0114
	0.70	7.1593	7.1442	7.0979	7.0174	6.9007	6.7501	6.5756	6.3921	6.2137	6.0496	5.9040
	0.80	7.1490	7.1321	7.0800	6.9892	6.8575	6.6895	6.4991	6.3045	6.1206	5.9555	5.8121
	0.90	7.1408	7.1221	7.0642	6.9630	6.8164	6.6319	6.4276	6.2245	6.0373	5.8728	5.7325
$\tilde{m}$	1.00	7.1341	7.1136	7.0499	6.9381	6.7769	6.5769	6.3606	6.1510	5.9623	5.7997	5.6630
	1.10	7.1286	7.1063	7.0367	6.9143	6.7387	6.5242	6.2977	6.0835	5.8945	5.7345	5.6019
	1.20	7.1239	7.0998	7.0243	6.8913	6.7015	6.4737	6.2386	6.0212	5.8331	5.6762	5.5477
	1.30	7.1199	7.0940	7.0126	6.8689	6.6653	6.4251	6.1830	5.9637	5.7772	5.6237	5.4994
	1.40	7.1164	7.0887	7.0013	6.8470	6.6299	6.3786	6.1307	5.9105	5.7262	5.5763	5.4562
	1.50	7.1134	7.0838	6.9905	6.8255	6.5954	6.3339	6.0814	5.8612	5.6794	5.5333	5.4172
	1.60	7.1108	7.0793	6.9800	6.8043	6.5616	6.2910	6.0349	5.8153	5.6364	5.4941	5.3820
	1.70	7.1084	7.0751	6.9697	6.7834	6.5286	6.2498	5.9910	5.7726	5.5968	5.4583	5.3500
	1.80	7.1063	7.0712	6.9597	6.7627	6.4964	6.2103	5.9496	5.7328	5.5602	5.4255	5.3208
	1.90	7.1044	7.0675	6.9499	6.7423	6.4649	6.1723	5.9104	5.6955	5.5263	5.3953	5.2941
	2.00	7.1027	7.0639	6.9402	6.7221	6.4341	6.1359	5.8734	5.6607	5.4949	5.3674	5.2696

TABLE III: $\alpha_3(\tilde{m},\tilde{r})$: table of eigenvalues of mode 3 for $0 \leq \tilde{m} \leq 2$ and $0 \leq \tilde{r} \leq 0.1$.

Mode 4: $\alpha_4(\tilde{m},\tilde{r})$

		$\tilde{r}$										
		0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
	0.00	10.9955	10.9955	10.9955	10.9955	10.9955	10.9955	10.9955	10.9955	10.9955	10.9955	10.9955
	0.10	10.5218	10.5127	10.4849	10.4372	10.3676	10.2745	10.1581	10.0210	9.8698	9.7129	9.5591
	0.20	10.4016	10.3862	10.3387	10.2555	10.1325	9.9701	9.7771	9.5714	9.3720	9.1921	9.0377
	0.30	10.3480	10.3269	10.2607	10.1427	9.9681	9.7450	9.5000	9.2643	9.0586	8.8894	8.7547
	0.40	10.3178	10.2910	10.2061	10.0527	9.8278	9.5550	9.2796	9.0376	8.8423	8.6913	8.5764
	0.50	10.2984	10.2660	10.1620	9.9726	9.7003	9.3899	9.1010	8.8654	8.6860	8.5530	8.4547
	0.60	10.2850	10.2469	10.1235	9.8976	9.5823	9.2460	8.9550	8.7317	8.5690	8.4519	8.3669
	0.70	10.2751	10.2313	10.0882	9.8257	9.4728	9.1205	8.8348	8.6260	8.4788	8.3751	8.3008
	0.80	10.2675	10.2181	10.0547	9.7563	9.3715	9.0111	8.7349	8.5409	8.4077	8.3152	8.2494
	0.90	10.2615	10.2064	10.0225	9.6889	9.2779	8.9156	8.6511	8.4714	8.3503	8.2672	8.2083
$\tilde{m}$	1.00	10.2566	10.1958	9.9911	9.6236	9.1919	8.8321	8.5803	8.4138	8.3033	8.2280	8.1749
	1.10	10.2526	10.1860	9.9602	9.5603	9.1128	8.7587	8.5199	8.3654	8.2641	8.1954	8.1471
	1.20	10.2492	10.1768	9.9297	9.4992	9.0403	8.6941	8.4680	8.3243	8.2309	8.1679	8.1237
	1.30	10.2463	10.1681	9.8994	9.4403	8.9738	8.6369	8.4229	8.2890	8.2026	8.1444	8.1037
	1.40	10.2438	10.1597	9.8694	9.3837	8.9128	8.5861	8.3836	8.2585	8.1781	8.1242	8.0864
	1.50	10.2417	10.1516	9.8396	9.3293	8.8568	8.5408	8.3490	8.2317	8.1568	8.1065	8.0713
	1.60	10.2398	10.1438	9.8099	9.2773	8.8054	8.5002	8.3184	8.2082	8.1380	8.0910	8.0580
	1.70	10.2381	10.1361	9.7804	9.2275	8.7580	8.4636	8.2912	8.1874	8.1214	8.0772	8.0463
	1.80	10.2366	10.1286	9.7511	9.1799	8.7145	8.4307	8.2668	8.1687	8.1066	8.0650	8.0358
	1.90	10.2352	10.1212	9.7220	9.1345	8.6743	8.4008	8.2449	8.1521	8.0933	8.0540	8.0264
	2.00	10.2340	10.1139	9.6931	9.0913	8.6371	8.3737	8.2251	8.1370	8.0813	8.0440	8.0179

TABLE IV: $\alpha_4(\tilde{m},\tilde{r})$: table of eigenvalues of mode 4 for $0 \leq \tilde{m} \leq 2$ and $0 \leq \tilde{r} \leq 0.1$.

Mode 5: $\alpha_5(\tilde{m},\tilde{r})$

		$\tilde{r}$										
		0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10
	0.00	14.1372	14.1372	14.1372	14.1372	14.1372	14.1372	14.1372	14.1372	14.1372	14.1372	14.1372
	0.10	13.6142	13.5953	13.5364	13.4314	13.2743	13.0670	12.8284	12.5890	12.3745	12.1966	12.0553
	0.20	13.5067	13.4742	13.3700	13.1781	12.8973	12.5727	12.2730	12.0358	11.8619	11.7373	11.6475
	0.30	13.4615	13.4160	13.2659	12.9859	12.6053	12.2337	11.9480	11.7515	11.6196	11.5296	11.4665
	0.40	13.4367	13.3782	13.1803	12.8138	12.3660	11.9938	11.7428	11.5833	11.4805	11.4116	11.3637
	0.50	13.4210	13.3494	13.1019	12.6552	12.1717	11.8212	11.6053	11.4741	11.3911	11.3359	11.2975
	0.60	13.4102	13.3253	13.0267	12.5097	12.0149	11.6941	11.5082	11.3981	11.3291	11.2833	11.2514
	0.70	13.4023	13.3040	12.9532	12.3778	11.8882	11.5980	11.4367	11.3425	11.2837	11.2447	11.2175
	0.80	13.3963	13.2843	12.8808	12.2594	11.7854	11.5236	11.3821	11.3002	11.2491	11.2151	11.1914
	0.90	13.3916	13.2658	12.8096	12.1539	11.7012	11.4646	11.3392	11.2669	11.2218	11.1918	11.1709
$\tilde{m}$	1.00	13.3878	13.2479	12.7398	12.0603	11.6314	11.4169	11.3047	11.2401	11.1998	11.1730	11.1542
	1.10	13.3846	13.2305	12.6715	11.9774	11.5730	11.3777	11.2764	11.2181	11.1817	11.1574	11.1404
	1.20	13.3820	13.2134	12.6051	11.9040	11.5237	11.3449	11.2527	11.1997	11.1665	11.1444	11.1288
	1.30	13.3797	13.1966	12.5408	11.8390	11.4816	11.3172	11.2327	11.1841	11.1536	11.1333	11.1190
	1.40	13.3778	13.1798	12.4788	11.7811	11.4454	11.2934	11.2155	11.1707	11.1425	11.1237	11.1104
	1.50	13.3761	13.1632	12.4193	11.7296	11.4139	11.2728	11.2007	11.1590	11.1329	11.1154	11.1030
	1.60	13.3746	13.1465	12.3622	11.6836	11.3863	11.2549	11.1876	11.1489	11.1244	11.1081	11.0965
	1.70	13.3733	13.1299	12.3078	11.6424	11.3620	11.2391	11.1762	11.1398	11.1170	11.1016	11.0907
	1.80	13.3721	13.1132	12.2558	11.6052	11.3404	11.2251	11.1660	11.1318	11.1103	11.0958	11.0856
	1.90	13.3711	13.0966	12.2065	11.5718	11.3212	11.2125	11.1569	11.1247	11.1043	11.0906	11.0810
	2.00	13.3701	13.0798	12.1596	11.5414	11.3039	11.2013	11.1487	11.1182	11.0989	11.0860	11.0768

TABLE V: $\alpha_5(\tilde{m},\tilde{r})$: table of eigenvalues of mode 5 for $0 \leq \tilde{m} \leq 2$ and $0 \leq \tilde{r} \leq 0.1$.