Support Information

Comparative study of numerical simulation on short-term creep behavior of steam-pretreated white oak (Quercus alba L.) wood

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The fitting parameters of the Burger model and the Five-parameter model for the short-term bending creep of white oak wood under different steam pretreatment conditions are presented in Tables 1 to 8. Upon analysis of the data, it can be concluded that the average coefficient of determination (R^2) is 0.893 for the Burger model, while for the Five-parameter model it is 0.966. Since the Five-parameter model introduces an expression for the nonlinear growth of bending creep that is more consistent with the actual creep process of wood, it demonstrates a clear advantage over the Burger model in predicting and characterizing the creep properties of oak wood. Relevant findings can be found in Exhibits Table S1-8.

Table S1. Burger model fitting creep parameters of samples without steam treatment at different test temperatures.

Specimen NO.	E_1	E_2	η_1	η_2	R^2
30 °C-A	96.472	7.15E+44	2.31E+44	16855.284	0.867
30 °C-B	102.563	6.46E+42	3.61E+43	18340.443	0.871
40 °C-A	80.666	-1.10E+44	-5.71E+44	15195.162	0.870
40 °C-B	94.528	6.11E+44	1.98E+44	14221.747	0.881
50 °C-A	72.094	3.13E+45	1.67E+45	8547.045	0.896
50 °C-B	87.449	5.67E+45	1.86E+45	7842.162	0.924
60 °C-A	68.560	1.22E+44	6.54E+44	5947.853	0.922
60 °C-B	70.487	4.02E+43	2.32E+44	7387.919	0.910
70 °C-A	62.001	-2.90E+41	-1.56E+42	4798.748	0.924
70 °C-B	63.964	-5.83E+44	-2.00E+44	5155.956	0.916
80 °C-A	47.898	-1.62E+45	-5.62E+44	3900.195	0.926
80 °C-B	49.024	-1.53E+44	-8.28E+44	3927.995	0.931

Table S2. Burger model fitting creep parameters of saturated steaming 100 °C samples at different test temperatures.

Specimen NO.	E_1	E_2	η_1	η_2	R^2
30 °C-A_1	103.829	-7.31E+44	-2.27E+44	27949.608	0.880
30 °C-B_1	126.497	3.00E+43	1.54E+44	18504.063	0.905
40 °C-A_1	89.600	5.30E+43	2.85E+44	11022.091	0.934
40 °C-B_1	114.225	-1.66E+45	-5.35E+44	9483.929	0.933
50 °C-A_1	82.567	-7.15E+45	-2.91E+45	7770.446	0.934
50 °C-B_1	100.392	1.15E+44	7.39E+44	6815.387	0.958
60 °C-A_1	72.921	-4.84E+44	-7.29E+43	9559.519	0.886
60 °C-B_1	80.951	-9.39E+44	-3.05E+44	11029.668	0.895
70 °C-A_1	57.365	6.62E+43	3.37E+44	6132.116	0.922
70 °C-B_1	66.851	-1.53E+45	-5.26E+44	5066.686	0.908
80 °C-A_1	49.212	1.45E+41	7.76E+41	4826.193	0.949
80 °C-B_1	58.633	-2.11E+43	-1.32E+44	4192.939	0.929

Table S3. The Burger model fitting creep parameters of the sample with superheated 110 °C steam at different test temperatures.

Specimen NO.	E_1	E_2	η_1	η_2	R^2
30 °C-A_2	168.776	6.93E+44	2.21E+44	27197.921	0.769
30 °C-B_2	186.5623	-1.42E+45	-4.11E+44	29350.408	0.861
40 °C-A_2	145.942	-1.26E+45	-1.65E+44	24804.909	0.875
40 °C-B_2	170.074	2.34E+45	8.29E+44	28276.430	0.856
50 °C-A_2	107.007	3.92E+45	5.01E+45	9725.024	0.9240
50 °C-B_2	126.282	3.36E+44	1.36E+44	14192.547	0.911
60 °C-A_2	91.464	3.18E+45	1.17E+45	5488.201	0.947
60 °C-B_2	100.523	-3.86E+45	-1.26E+45	6022.238	0.950
70 °C-A_2	74.285	-1.20E+45	-3.60E+44	8442.396	0.913
70 °C-B_2	77.690	-3.02E+45	-9.75E+44	8012.210	0.916
80 °C-A_2	57.365	6.62E+43	3.37E+44	6132.11565	0.922
80 °C-B_2	59.180	2.52E+45	1.24E+45	6058.58111	0.933

Table S4. The Burger model fitting creep parameters of samples heated at 120 °C steam at different test temperatures.

Specimen NO.	E_1	E_2	η_1	η_2	R^2
30 °C-A_3	182.084	1.28E+43	7.35E+43	46959.141	0.872
30 °C-B_3	220.195	2.40E+43	9.60E+43	92886.583	0.902
40 °C-A_3	180.912	4.92E+43	2.59E+44	44523.969	0.905
40 °C-B_3	222.099	4.21E+43	1.00E+44	60036.345	0.981
50 °C-A_3	136.214	-7.29E+44	-2.27E+44	26212.793	0.893
50 °C-B_3	194.608	9.36E+44	2.92E+44	27569.836	0.927
60 °C-A_3	131.587	-8.76E+44	-2.60E+44	14156.450	0.947
60 °C-B_3	171.263	2.88E+45	9.34E+44	12846.751	0.954
70 °C-A_3	127.687	7.95E+43	4.59E+44	8946.143	0.973
70 °C-B_3	124.176	1.16E+45	3.76E+44	15004.022	0.863
80 °C-A_3	80.812	1.59E+44	8.58E+44	5546.005	0.925
80 °C-B_3	82.695	5.54E+44	1.86E+44	5994.681	0.9148

Table S5. The fitting creep parameters of the Five-parameter model for samples without steam treatment at different test temperatures.

Specimen NO.	A	B	E_1	E_2	η_2	R^2
30 °C-A	-420.470	0.070	105.324	26.923	383.710	0.987
30 °C-B	4594.654	0.071	112.675	-2.93E+30	-2.37E+31	0.986
40 °C-A	-2.611	33.651	43.904	276.464	3855.297	0.990
40 °C-B	6917.286	0.041	111.804	698.629	1649.814	0.999
50 °C-A	2598.940	0.0605	80.389	-4.43E+24	7.58E+25	0.991
50 °C-B	2856.136	0.050	97.952	1.17E+29	-6.15E+30	0.996
60 °C-A	938.799	0.360	86.573	105.74244	3620.161	0.999
60 °C-B	2336.206	0.057	79.912	-5.75E+30	-5.40E+31	0.991
70 °C-A	1694.844	0.051	71.574	4.02E+24	-4.75E+25	0.990
70 °C-B	753.431	0.364	83.392	90.183	3249.300	0.999
80 °C-A	1449.870	0.049	54.083	-4.49E+19	-9.65E+19	0.993
80 °C-B	1457.221	0.049	55.551	-2.68E+40	-4.17E+40	0.992

Table S6. The fitting creep parameters of the Five-parameter model at different test temperatures for samples treated at 100 °C by saturated steam.

Specimen NO.	A	B	E_1	E_2	η_2	R^2
30 °C-A_1	15778.602	0.034	114.636	1130.711	2659.174	0.999
30 °C-B_1	2788.841	0.383	147.153	347.033	9259.511	0.999
40 °C-A_1	1762.667	0.374	104.493	181.884	6903.646	0.999
40 °C-B_1	3681.782	0.046	127.658	-2.94E+21	1.29E+23	0.995
50 °C-A_1	3062.587	0.046	90.792	1.74E+30	-5.57E+31	0.993
50 °C-B_1	3101.352	0.037	111.892	-7.30E+23	-9.67E+24	0.996
60 °C-A_1	1205.624	0.466	87.462	186.749	4215.384	0.999
60 °C-B_1	1468.455	0.351	95.897	208.151	6627.543	0.999
70 °C-A_1	1208.024	0.315	67.931	111.487	3671.235	0.999
70 °C-B_1	1669.670	0.056	78.242	2.35E+27	-2.13E+28	0.994
80 °C-A_1	2055.603	0.041	53.465	-2.52E+18	-2.36E+19	0.993
80 °C-B_1	1510.648	0.049	68.582	2.42E+23	-2.33E+24	0.991

Table S7. The fitting creep parameters of the Five-parameter model for the sample with superheated steam at 110 °C at different test temperatures.

Specimen NO.	A	B	E_1	E_2	η_2	R^2
30 °C-A_2	6683.969	0.079	216.387	1222.163	2056.056	0.999
30 °C-B_2	16672.429	0.036	223.157	1123.984	3120.471	0.999
40 °C-A_2	6773.091	0.067	152.023	-3511.574	-26.199	0.984
40 °C-B_2	13711.310	0.043	202.227	1163.547	2888.738	0.999
50 °C-A_2	1869.251	0.332	130.751	172.982	5793.470	0.999
50 °C-B_2	7923.874	0.033	150.669	848.848	2380.549	0.999
60 °C-A_2	1300.943	0.312	117.095	83.489	3796.572	0.99
60 °C-B_2	2660.749	0.0394	113.972	4.14E+24	-1.71E+25	0.996
70 °C-A_2	2906.348	0.053	81.735	2.50E+29	-7.00E+30	0.988
70 °C-B_2	2767.670	0.053	86.360	2.06E+29	-8.01E+29	0.994
80 °C-A_2	1208.024	0.315	67.931	111.487	3671.235	0.999
80 °C-B_2	1018.861	0.347	70.477	96.029	4171.557	0.999

Table S8. The fitting creep parameters of the Five-parameter model at different test temperatures for superheated steam samples at 120 °C.

Specimen NO.	A	B	E_1	E_2	η_2	R^2
30 °C-A_3	25797.830	0.036	202.174	1874.385	5566.644	0.999
30 °C-B_3	-518.238	66.596	207.216	1.01E+25	-2.79E+25	-0.047
40 °C-A_3	22530.198	0.037	198.238	2436.474	6053.879	0.999
40 °C-B_3	55670.853	0.003	221.781	-1.10E+28	-2.54E+30	0.979
50 °C-A_3	7887.938	0.061	141.203	4660.464	-56.602	0.995
50 °C-B_3	13955.306	0.035	220.423	2165.890	4389.115	0.999
60 °C-A_3	6126.203	0.040	136.619	-4202.343	-51.786	0.996
60 °C-B_3	8027.707	0.0245	205.270	1179.577	2948.016	0.999
70 °C-A_3	4651.308	0.0301	138.599	-4.50E+18	-5.41E+19	0.997
70 °C-B_3	317.862	0.691	170.510	-1506.908	-326.185	0.398
80 °C-A_3	1069.055	0.337	106.693	100.042	3210.971	0.999
80 °C-B_3	1135.370	0.329	108.190	110.034	3448.070	0.999