Table of Normalized Butterworth lowpass polynomails

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Using my own DSP mathematica package, the following table is generated for the normalized low pass Butterworh polynomials. In this table, the filter order N is give, then H(s) is given. The function used also returns the stable poles, but these are not displayed.

In[159]:=
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<< dsp`

data = Table[dsp`getButterworthPolynomial[n, 1, s, form → "quadratic"], {n, 1, 20}];
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In[193]:=
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tbl = Table[{n, data[[n, 2]]}, {n, 1, Length[data]}];
TableForm[N@tbl, TableHeadings → {None, {"N", "H(s)"}}, TableAlignments → Left]
```

In[199]:=
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Do[{Print["N=", n, "\t", N@tbl[[n, 2]]]; Print[""]}, {n, 1, Length[data]}]
```

N=1 $\frac{1.}{1.+s}$

N=2 $\frac{1.}{1.+1.41421\,s+s^2}$

N=3 $\frac{1.}{1.+s}-\frac{1.\,s}{1.+s+s^2}$

N=4 $\frac{-0.707107-0.92388\,s}{1.+0.765367\,s+s^2}+\frac{1.70711+0.92388\,s}{1.+1.84776\,s+s^2}$

N=5 $\frac{1.89443}{1.+s}+\frac{-1.78885-0.552786\,s}{2.+1.23607\,s+2.\,s^2}-\frac{3.23607\,s}{2.+3.23607\,s+2.\,s^2}$

N=6 $\frac{-2.1547-3.04721\,s}{1.+1.41421\,s+s^2}+\frac{-1.1547+0.816497\,s}{2.+1.03528\,s+2.\,s^2}+\frac{7.4641+5.27792\,s}{2.+3.8637\,s+2.\,s^2}$

N=7 $\frac{4.31194}{1.+s}+\frac{0.736976\,s}{1.+0.445042\,s+s^2}+\frac{-3.31194-2.06496\,s}{1.+1.24698\,s+s^2}-\frac{2.98396\,s}{1.+1.80194\,s+s^2}$

N=8 $\frac{0.5+0.587938\,s}{1.+0.390181\,s+s^2}+\frac{-6.06854-8.4173\,s}{1.+1.66294\,s+s^2}+\frac{9.08221+7.13584\,s}{1.+1.96157\,s+s^2}+\frac{-2.51367+0.69352\,s}{1.+1.11114\,s+1.\,s^2}$

N=9 $\frac{10.7211}{1.+s}+\frac{0.666667+0.115765\,s}{1.+0.347296\,s+s^2}+\frac{3.27432\,s}{1.+s+s^2}-\frac{6.1537\,s}{1.+1.87939\,s+s^2}+\frac{-10.3878-7.95753\,s}{1.+1.53209\,s+1.\,s^2}$

N=10 $\frac{0.447214-0.371748\,s}{1.+0.312869\,s+s^2}+\frac{2.8236+3.79773\,s}{1.+0.907981\,s+s^2}-\frac{8.69013}{1.+1.41421\,s+s^2}+\frac{-17.0553-22.9394\,s}{1.+1.78201\,s+s^2}+\frac{23.4747+19.5134\,s}{1.+1.97538\,s+s^2}$

N=11 $\frac{28.0831}{1.+s}-\frac{0.596885\,s}{1.+0.28463\,s+s^2}+\frac{4.19411+1.7423\,s}{1.+0.83083\,s+s^2}+\frac{10.795\,s}{1.+1.30972\,s+s^2}+\frac{-31.2773-26.3121\,s}{1.+1.68251\,s+s^2}-\frac{13.7115\,s}{1.+1.91899\,s+s^2}$

N=12 $\frac{-0.408248-0.458043\,s}{1.+0.261052\,s+s^2}+\frac{3.10095-1.67822\,s}{1.+0.765367\,s+s^2}+\frac{11.5729+16.2266\,s}{1.+1.21752\,s+s^2}+\frac{-27.9395-5.1574\,s}{1.+1.58671\,s+s^2}+\frac{-48.3926-63.228\,s}{1.+1.84776\,s+s^2}+\frac{63.0665+54.2951\,s}{1.+1.98289\,s+s^2}$

N=13 $\frac{76.1374}{1.+s}+\frac{-0.5547-0.0668617\,s}{1.+0.241073\,s+s^2}-\frac{4.2715\,s}{1.+0.70921\,s+s^2}+\frac{18.5346+10.5288\,s}{1.+1.13613\,s+s^2}+\frac{32.4079\,s}{1.+1.49702\,s+s^2}+\frac{-93.1173-82.4512\,s}{1.+1.77091\,s+s^2}-\frac{32.2846\,s}{1.+1.94188\,s+s^2}$

N=14 $\frac{-0.377964+0.333269\,s}{1.+0.223929\,s+s^2}+\frac{-3.35453-4.27421\,s}{1.+0.660558\,s+s^2}+\frac{14.6971-4.62508\,s}{1.+1.06406\,s+s^2}+\frac{42.002+59.3998\,s}{1.+1.41421\,s+s^2}+\frac{-87.2181-27.4469\,s}{1.+1.69345\,s+s^2}+\frac{-138.807-176.862\,s}{1.+1.88777\,s+s^2}+\frac{174.058+153.475\,s}{1.+1.98742\,s+s^2}$

N=15 $\frac{211.525}{1.+s}+\frac{0.513569\,s}{1.+0.209057\,s+s^2}-\frac{20.018\,s}{1.+s+s^2}+\frac{71.14+47.6019\,s}{1.+1.33826\,s+s^2}-\frac{79.197\,s}{1.+1.9563\,s+s^2}+\frac{-276.752-252.826\,s}{1.+1.82709\,s+1.\,s^2}+\frac{-9.82639-3.03652\,s}{2.+1.23607\,s+2.\,s^2}+\frac{187.836\,s}{2.+3.23607\,s+2.\,s^2}$

N=16 $\frac{0.353553+0.386505\,s}{1.+0.196034\,s+s^2}+\frac{-3.58969+2.39309\,s}{1.+0.580569\,s+s^2}+\frac{-18.0466-24.4228\,s}{1.+0.942793\,s+s^2}+\frac{59.4916-8.24656\,s}{1.+1.26879\,s+s^2}+\frac{143.625+202.139\,s}{1.+1.54602\,s+s^2}+\frac{-268.704-110.31\,s}{1.+1.76384\,s+s^2}+\frac{-402.144-501.565\,s}{1.+1.91388\,s+s^2}+\frac{490.014+439.625\,s}{1.+1.99037\,s+s^2}$

N=17 $\frac{598.486}{1.+s}+\frac{0.485071+0.0447567\,s}{1.+0.184537\,s+s^2}+\frac{5.03492\,s}{1.+0.547326\,s+s^2}+\frac{-28.0035-12.4822\,s}{1.+0.891477\,s+s^2}-$
$\frac{78.5424\,s}{1.+1.20527\,s+s^2}+\frac{254.056+187.75\,s}{1.+1.47802\,s+s^2}+\frac{268.593\,s}{1.+1.70043\,s+s^2}+\frac{-824.024-768.379\,s}{1.+1.86494\,s+s^2}-\frac{200.504\,s}{1.+1.96595\,s+s^2}$

N=18 $\frac{0.333333-0.303013\,s}{1.+0.174311\,s+s^2}+\frac{-21.6077+10.4514\,s}{1.+0.845237\,s+s^2}+$
$\frac{-80.641-112.311\,s}{1.+1.14715\,s+s^2}+\frac{221.559}{1.+1.41421\,s+s^2}+\frac{475.135+661.735\,s}{1.+1.6383\,s+s^2}+\frac{-822.959-398.056\,s}{1.+1.81262\,s+s^2}+$
$\frac{1400.68+1273.27\,s}{1.+1.99239\,s+s^2}+\frac{7.62003+9.3326\,s}{2.+1.03528\,s+2.\,s^2}+\frac{-2350.61-2878.9\,s}{2.+3.8637\,s+2.\,s^2}$

N=19 $\frac{1717.48}{1.+s}-\frac{0.457264\,s}{1.+0.165159\,s+s^2}+\frac{5.53727+1.35932\,s}{1.+0.490971\,s+s^2}+\frac{30.3882\,s}{1.+0.803391\,s+s^2}+\frac{-131.037-71.6704\,s}{1.+1.0939\,s+s^2}-$
$\frac{280.824\,s}{1.+1.35456\,s+s^2}+\frac{870.183+686.696\,s}{1.+1.57828\,s+s^2}+\frac{765.303\,s}{1.+1.75895\,s+s^2}+\frac{-2461.16-2327.81\,s}{1.+1.89163\,s+s^2}-\frac{520.464\,s}{1.+1.97272\,s+s^2}$

N=20 $\frac{-0.316228-0.340064\,s}{1.+0.156918\,s+s^2}+\frac{4.01805-2.96904\,s}{1.+0.466891\,s+s^2}+\frac{25.369+33.1462\,s}{1.+0.765367\,s+s^2}+$
$\frac{-105.669+34.8859\,s}{1.+1.045\,s+s^2}+\frac{-325.217-458.509\,s}{1.+1.2989\,s+s^2}+\frac{785.144+87.1179\,s}{1.+1.52081\,s+s^2}+$
$\frac{1540.93+2118.99\,s}{1.+1.70528\,s+s^2}+\frac{-2514.57-1360.88\,s}{1.+1.84776\,s+s^2}+\frac{-3461.01-4173.34\,s}{1.+1.94474\,s+s^2}+\frac{4052.32+3721.89\,s}{1.+1.99383\,s+s^2}$