$$
\begin{aligned}
X_N(z) &:= \sum_{\nu=0}^{N} h_\nu z^{-\nu} \ , \quad |z| = 1 \ , \\
\Psi'_N(\theta) &:= \frac{1}{2\pi} |X_N(e^{\mathrm{i}\,\theta})|^2 \ , \quad -\pi \le \theta \le \pi \ .
\end{aligned}
$$

Moments for this distribution:

$$
\begin{aligned}
\mu_j &:= \int_{-\pi}^{\pi} e^{-\mathrm{i}\,j\theta}\, d\Psi_N(\theta) \ , \quad j \in \mathbb{Z} \ , \\
&= \begin{cases} \displaystyle\sum_{k=0}^{N-j-1} h_k \overline{h}_{k+j} \ , & j = 0, 1, 2, \ldots , \\ \overline{\mu}_{-j} \ , & j = -1, -2, -3, \ldots \end{cases} \\
\Delta_n &:= \det(\mu_{i-j})_{i,j=0,\ldots,n}
\end{aligned}
$$

$\tilde{s}_0(z) := 1,\ \tilde{s}_0^\star(z) := 1,$

$$\tilde{s}_n(z) := \frac{1}{\Delta_{n-1}} \begin{vmatrix} \mu_0 & \cdots & \mu_{-n} \\ \vdots & & \vdots \\ \mu_{n-1} & \cdots & \mu_{-1} \\ 1 & \cdots & z^n \end{vmatrix},$$

$$\tilde{s}_n^\star(z) := \frac{1}{\Delta_{n-1}} \begin{vmatrix} \mu_0 & \cdots & \mu_n \\ \vdots & & \vdots \\ \mu_{-n+1} & \cdots & \mu_1 \\ z^n & \cdots & 1 \end{vmatrix}, \qquad n \geq 1,$$

$(\tilde{s}_\nu)_{\nu \in \mathbb{N}_0}$ monic, orthogonal with respect to

$$\langle f, g \rangle := \int_{-\pi}^{\pi} f(e^{\mathrm{i}\,\theta})\overline{g(e^{\mathrm{i}\,\theta})}\, d\Psi_N(\theta)$$

$$
\begin{aligned}
\tilde{s}_0(z) &:= \tilde{s}_0(z) := 1\ , \\
\tilde{s}_n(z) &= z\tilde{s}_{n-1}(z) + a_n \tilde{s}^\star_{n-1}(z)\ , \\
\tilde{s}^\star_n(z) &= \overline{a}_n z \tilde{s}^\star_n(z) + \tilde{s}_{n-1}(z)\ , \quad n \geq 1\ .
\end{aligned}
$$

$$
\tilde{s}_{n-1}(z) =: \sum_{\nu=0}^{n-1} p_\nu^{(n-1)} z^\nu\ , \quad n \geq 1\ ,
$$

$$
a_n = \tilde{s}_n(0) = -\frac{\langle z\tilde{s}_{n-1}, 1\rangle}{\langle \tilde{s}^\star_{n-1}, 1\rangle} = -\frac{\sum_{\nu=0}^{n-1} p_\nu^{(n-1)} \mu_{-\nu-1}}{\sum_{\nu=0}^{n-1} p_\nu^{(n-1)} \mu_{\nu+1-n}}
$$

$$
\begin{aligned}
\delta_n &:= \langle \tilde{s}_n, \tilde{s}_n \rangle = \langle \tilde{s}_n^\star, \tilde{s}_n^\star \rangle \quad n \geq 0 \ , \\
&= \delta_{n-1}(1 - |a_n|^2) \ , \quad n \geq 1 \ , \\
&= \mu_0 \prod_{k=1}^{n} (1 - |a_k|^2) \ , \quad n \geq 0 \ , \\
\langle \tilde{s}_n^\star, z\tilde{s}_n \rangle &= \langle \tilde{s}_n^\star, \tilde{s}_{n+1} - a_{n+1}\tilde{s}_n^\star \rangle = -a_{n+1}\delta_n
\end{aligned}
$$

Levinson Algorithm

$\tilde{s}_0(z) := 1, \; \delta_0 := \mu_0$
For $n = 0, 1, 2, \ldots$ do

$$\begin{aligned} a_{n+1} &:= -\frac{\langle z\tilde{s}_n, 1\rangle}{\delta_n} \,, \\ \tilde{s}_{n+1} &:= z\tilde{s}_n(z) + a_{n+1}\tilde{s}_n^\star(z) \,, \\ \delta_{n+1} &:= \delta_n(1 - |a_{n+1}|^2) \end{aligned}$$

done
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