# Annex 2: The Gelfand Levitan Marchenko method

Define $\widehat{r}$ the Fourier transform of $r$:

$$\widehat{r}(\tau) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} r(\beta) \exp(-i\beta\tau) d\beta \quad \tau \in \mathbf{R}$$

The GLM methods leads to the following integral equation for $\widehat{r}$:

$$\widehat{r}(\tau) = -\frac{1}{2} q(\frac{\tau}{2}) - \int_0^{\frac{\tau}{2}} dz_1 \int_0^{z_1} dz_2 q(z_1) \bar{q}(z_2) \widehat{r}(\frac{\tau}{2} - (z_1 - z_2))$$

The iterative algorithm is then the following:

$$\begin{cases} -\frac{1}{2} q^0(\frac{\tau}{2}) = \widehat{r}(\tau) \\ -\frac{1}{2} q^{n+1}(\frac{\tau}{2}) = \widehat{r}(\tau) + \int_0^{\frac{\tau}{2}} dz_1 \int_0^{z_1} dz_2 q^n(z_1) \bar{q}^n(z_2) \widehat{r}(\frac{\tau}{2} - (z_1 - z_2)) \end{cases}$$