Usgood

EE Qualifying Exam
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Let $\underline{f}$ and $\underline{g}$ be discrete, real signals, each periodic of period N. Define their correlation by the formula

$$(\underline{f} \star \underline{g})[m] = \sum_{n=-\frac{N}{2}+1}^{\frac{N}{2}} \underline{f}[n]\underline{g}[n+m]$$

(a) Show that

$$\underline{\mathcal{F}}(\underline{f} \star \underline{g}) = \overline{\underline{\mathcal{F}}\,\underline{f}}\,\underline{\mathcal{F}}\,\underline{g},$$

where $\underline{\mathcal{F}}$ is the discrete Fourier transform.

(b) Give an upper bound for $(\underline{f} \star \underline{g})[0]$.