Programming a Chirped Gaussian Pulse Spectrum
Abstract

VirtualLab Fusion provides the freedom to define the pulse spectrum, using the Programmable Pulse Spectrum. The generated spectrum can be used in combination with existing spatial source models. Users can not only specify a spectrum directly in frequency domain, but also possible in time domain, and VirtualLab will automatically calculate the corresponding spectrum. This example shows how to generate a chirped Gaussian pulse, with the specification given in time domain.
Task Description

*Specify a chirped Gaussian pulse in time domain by programming*

\[ E(t) = \exp(-at^2) \exp[i(\omega_0 t + bt^2)] \]  

(1)

with \( a = \frac{2\ln 2}{\tau_p^2} \), where \( \tau_p \) denoting the pulse duration, \( \omega_0 \) is carrier frequency, and \( b \) denoting the chirp coefficient.

*The Programmable Pulse Spectrum returns the relation spectrum of the specified pulse spectrum.*
Programmable Pulse Spectrum: Open Edit Window

- Initialization
  - Open the edit window of programmable pulse spectrum
Specification of Domain

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  - Select Specification in Time Domain, because the equation of chirped Gaussian pulse in time domain is used to specify the pulse / pulse spectrum.
Define the Carrier Wavelength

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  - Specify Carrier Wavelength in Eq. (1)

\[ \lambda_0 = \frac{2\pi c}{\omega_0} \]
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• Programming of pulse
$$E(t) = \exp(-at^2) \exp[i(\omega_0 t + bt^2)]$$  \hspace{1cm} (1)

with $a = \frac{2\ln 2}{\tau_p}$, where $\tau_p$ denoting the pulse duration, $\omega_0$ is carrier frequency, and $b$ denoting the chirp coefficient.
Programming of Pulse: Source Code

\[ E(t) = \exp(-at^2) \exp[i(\omega_0 t + bt^2)] \]  

with \( a = \frac{2\ln 2}{\tau_p^2} \), where \( \tau_p \) denoting the pulse duration, \( \omega_0 \) is carrier frequency, and \( b \) denoting the chirp coefficient.
Numerical Settings

• Initialization
  − Open the edit window of programmable pulse spectrum
  − Select Specification in Time Domain, because the equation of chirped Gaussian pulse in time domain is used to specify the pulse / pulse spectrum.
  − Specify Carrier Wavelength in Eq. (1)

\[
\lambda_0 = \frac{2\pi c}{\omega_0}
\]

• Programming of pulse
• Numerical Settings
  − Define proper sampling parameters
Results
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