LSIM Linear Simulation S58

Module of the KLIPPEL ANALYZER SYSTEM (Document Revision 1.0)

PRELIMINARY SPECIFICATION – NOT FOR RELEASE

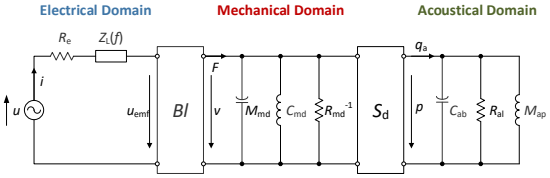
This specification is preliminary and is subject to change.

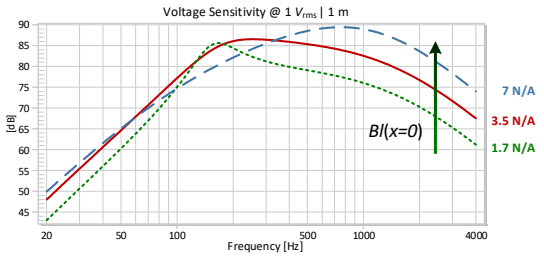
FEATURES

- SPL response, transfer functions, impedances
- Efficiency and voltage sensitivity
- Calculate acoustical parameters based on geometry
- Signal-related processing to evaluate efficiency for certain stimuli

BENEFITS

- Fast lumped parameter simulation
- Combination of amplifier, DSP, electrodynamic transducer and acoustical system
- Easy way to investigate influence of certain parameters
- Clear structure to get fast overview about loudspeaker systems





DESCRIPTION

The *LSIM Linear Simulation* module provides comprehensive capabilities to simulate the linear transfer behavior of transducers and loudspeaker systems, as well as possibilities to incorporate DSP based system equalization for active systems.

Based on lumped parameter modeling, transfer functions and measures used to design a system in its target application are available, including sound pressure level SPL(f), displacement $H_x(f)$, power efficiency $\eta(f)$, voltage sensitivity. All parameters can be specified by the user. In addition, the *LSIM* features an easy to use, geometrical based design for system enclosures, which is fully compatible with other Klippel simulation modules (such as *SIM Simulation*, or *SIM-AUR Simulation / Auralization*).

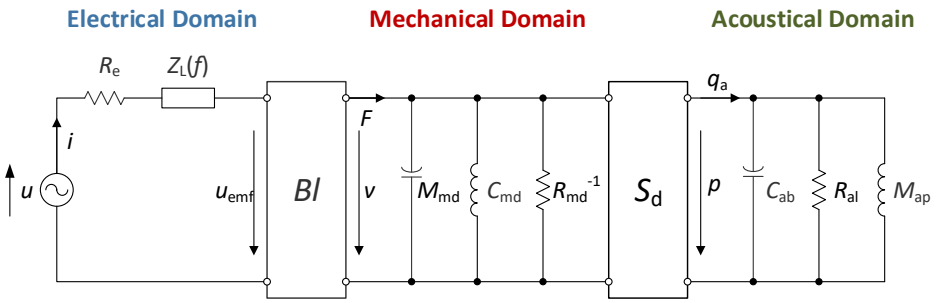
Article number	1000-300

CONTENT

1 Overview

1.1 Principle

Equivalent circuit



The *LSIM Linear* Simulation module uses lumped-parameter based modeling to simulate electro-dynamical transducers, mounted in common acoustical systems. Employing the knowledge about those elements, sound pressure level *SPL(f)*, transfer functions such as $H_x(f)$ or the electrical impedance Z_l(f), as well as efficiency $\eta(f)$ and voltage sensitivity can be easily predicted.

Note that the *LSIM* module only simulates the linear behavior of the system, which is considered valid at small amplitudes. Please see *SIM Simulation* or *SIM-AUR Simulation / Auralization* for nonlinear modeling.

Parameters

The linear parameters of the driver can be identified using the *LPM Linear Parameter Measurement* module, which is part of the Klippel Analyzer system. All parameters may be copied to the clipboard, and imported to the *LSIM*. The type and parameters of the enclosure and radiation conditions may be specified. The *LSIM* supports automatic calculation of the acoustic lumped parameters based on geometrical system information. No parameter import is requiered to consider the nonlinear compliance of the air.
Equalization parameters for DSP powered alignment of active system can be specified using different filter types, entering Q factor and cutoff frequencies of the filters.
To simulate the impact of the excitation, the spectrum of typical program material according to *IEC 60268-21* is provided, or may be imported from any given stimulus.

1.2 Results

Linear Transfer-functions

- $H_{pfar}(f,r)$ Sound pressure in far field (for given stimulus)
- $H_x(f)$ Displacement
- $H_v(f)$ Velocity
- $H_q(f)$ Volume-velocity
- $H_F(f)$ Force
- $Z_e(f)$ Impedance
- $H_g(f)$ Amplifier

Voltage Sensitivity

- Frequency depended voltage-sensitivity SPL(f) sinusoidal
- Reference Passband Sensitivity (SPL u_{ref}/r_{ref}) (single value)
- Total SPL for given stimulus (single value)

Efficiency	• Frequency depended efficiency • Total efficiency for given stimulus (single value)
Signal related processing	• State Spectrum (any of the transfer functions multiplied by the signal) • Stimulus (with alignment, without alignment) • Alignment (function of the alignment) • Power Spectrum (Input, Generator, Terminal, Output) • Voltage Spectrum (at generator, terminal)
Transducer Parameters	• Equivalent circuit presenting the electrical and mechanical domain (including R_g) • Table including all transducer related parameters

System Parameters	• Equivalent circuit representing the chosen acoustical system
	• Picture showing the structure of the acoustical system
	• Table:
	  ○ Geometrical parameters of the system
	  ○ Derived parameters of the acoustical system

Signal States	• State Signals of the system (related to the Stimulus)

2 Requirements

2.1 Hardware

Licence Device	*Klippel Dongle*, *Klippel Analyzer 3* or the *Distortion Analyzer 2* may be used to run this product.	

2.2 Software

dB-Lab (>210.560)	dB-Lab is the project management software of the KLIPPEL R&D SYSTEM.

3 Inputs

Transducer	Provides all parameters used to describe the electrodynamic transducer.
System	Provides all parameters used to describe the amplifier and acoustical system, including geometrical aspects of the box as well as the radiation conditions.
Signal	• Provides all signal related properties • Provides a section to configure equalization related properties
Display	• Definition of the area of interest (Frequency range) • Definition of some display properties • Definition of the transfer function which should be used for state-spectrum • Definitions for voltage-sensitivity • Definition of the constants (these are hidden)

4 Output

Lumped Parameters	Lumped parameters describing the system, which can be imported in other Klippel simulation products such as *SIM Simulation* or *SIM-AUR Simulation / Auralization*.
Transfer functions and additional measures	Transfer functions and additional measures, as defined in section 1.2.
Transducer Parameters	This page contains an image of the equivalent circuit representing the electrical and mechanical domain of the transducer. Additional to this, all available derived loudspeaker parameters are presented.
System Parameters	This page contains an image of the chosen acoustical system, representing the geometrical structure of the system. All geometrical parameters and all derived acoustical parameters are printed out in a table.
Signal States	This page contains any state variables which are calculated. These variables are based on the inputs for the stimulus.

5 References

5.1 Related Modules	*LPM* Linear Parameter Measurement, *SIM* Simulation, *SIM-AUR* Simulation / Auralization
5.2 Manuals	LSIM Manual, as provided with dB-Lab 210.560 or higher

Find explanations for symbols at:
http://www.klippel.de/know-how/literature.html
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