Interdisciplinary nature of electrical and electronics engineering studies.
Case study: Electronics Product Development and Technology Information Management (TIM)

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Objective(s)

- Provide insight to electrical engineering students in using basic electronic knowledge, well defined and well known functions and sub-modules building blocks in their project design
- Show relationships between circuit theory, system and control theory, signal processing and electronic in the context of designing an RMS-to-DC converter used in a wind turbine design
- Underline the importance of using engineering methodology guidelines such as: system requirements, specifications and architecture, algorithm, trade-off between Hardware and software, design for test, maintenance, manufacture and service and documentation.

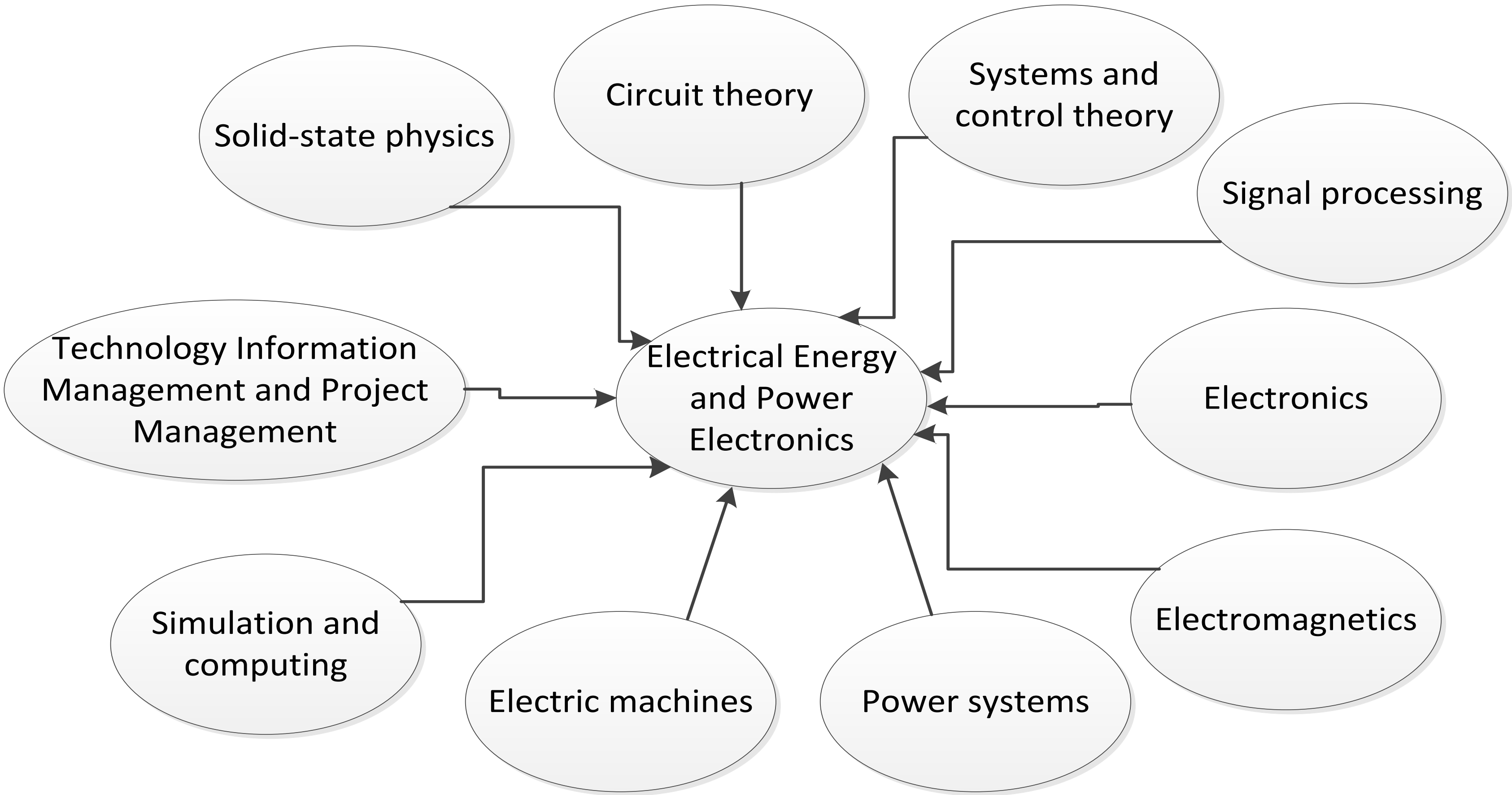
Core competency and complementary studies asset

- Electric – Electronic Engineering
  - Automatics
  - Telecommunications
  - Microelectronics
  - Electrical Energy
- Technology Information Management (TIM) in comparison to Industrial Engineering
  - Production
  - Organization and Technological Innovation
  - Technology Project Management

Case Study

- Electrical Energy and Power Electronics
- As electrical engineers advance in their career this profession becomes more and more interdisciplinary such as a difference of potential is built between the fields presented above and their areas of specialization not to repulse them apart but to create a necessary and tightly connected knowledge network space. The following case study symbolizes this paradox in the next figure

Interdisciplinary Study



Waveforms signals

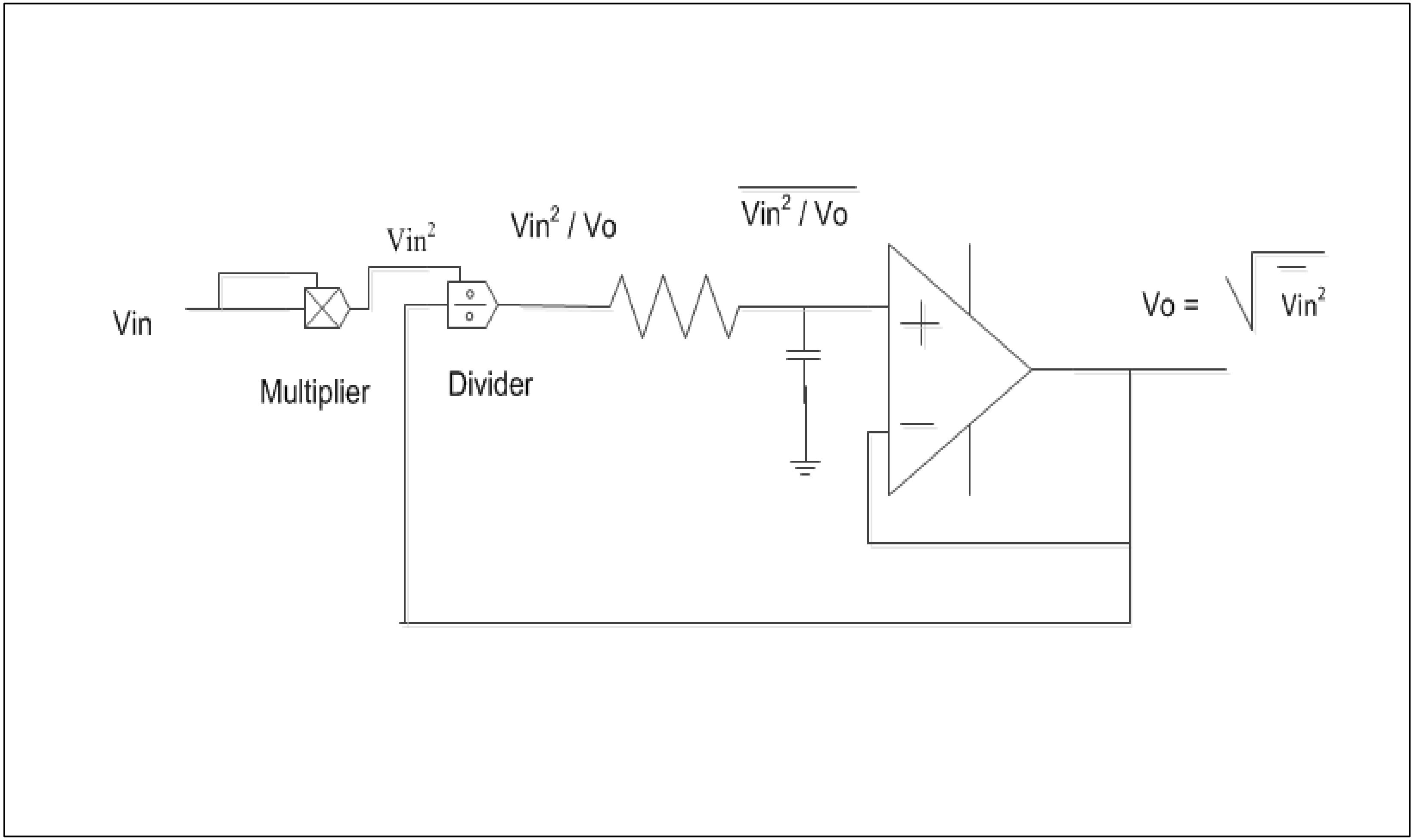
Waveforms signals	
Periodic (parameters)	Non-periodic (parameters)
Sine wave (amplitude, peak, peak to peak, RMS, average, Frequency)	DC signal (amplitude, ripple)
Square wave (rise time, fall time, duty cycle, overshoot, slew rate)	Random signal
Saw tooth wave	Isolated pulse

Equations and Measurements Methods

Useful Equations		
Average value	Root mean Square	Rectified mean or mean absolute deviation
$V_{avg} = \frac{1}{T}\int_0^T v(t)dt$	$V_{rms} = \sqrt{\frac{1}{T}\int_0^T v(t)^2}$	$V_{mad} = \frac{1}{T}\int_0^T \lvert v(t) \rvert dt$

Methods of RMS Measurement	
1	Rectified and average, analog computing
2	Thermal
3	Sampling techniques

RMS Measurements using simple blocks



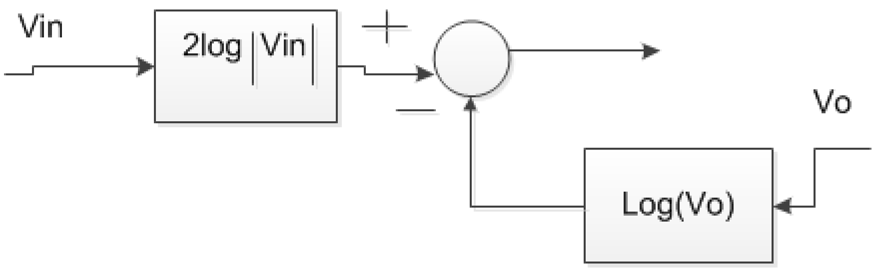
RMS Measurements using simple blocks

In the previous design if we change the divider for a log module that implies v_in^2/ V_o yields to

Log (v_in^2/ V_o) = log (v_in^2) – log (V_o)

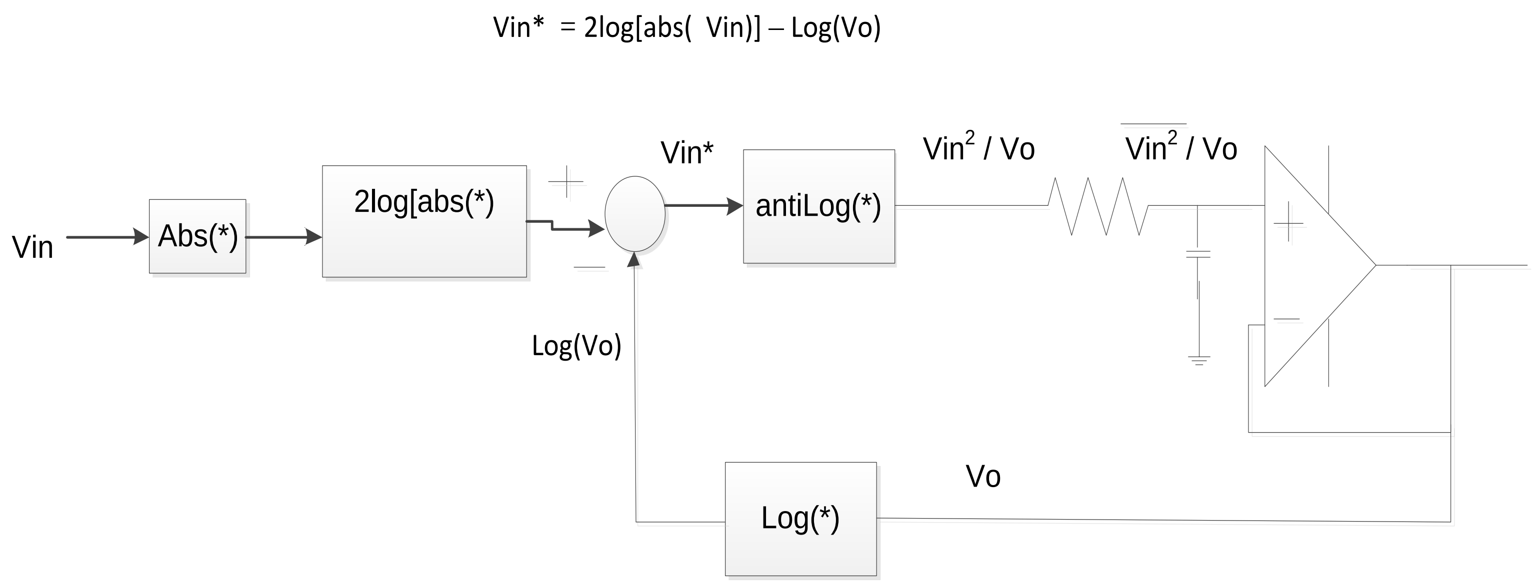
Log (v_in^2/ V_o) = 2log [abs(v_in)] – log (V_o)

A control bloc diagram for the previous equation can be



RMS Measurements using simple blocks

Then by replacing the divider module by a log, the previous measurement control system becomes



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