International Future Energy Challenge: Overview of Competition & Updates

Brian Johnson General Chair for IFEC 2024

APEC 2024 in Long Beach, CA, on February 25th, 2024





IFEC 2024: Agenda for Workshop

- Acknowledgment of support from PELS, IAS, & PMSA
- Brian will give overview of technical objectives and updates on technical specifications
- Mathworks tutorial on software tools (9:15am -10:15am)
- Student presentations (10:15am 4:15pm)
 - 25 minutes total each (20 minutes presentation + 5 minutes Q&A)
- Panel will give closing remarks (4:15pm)





IFEC 2024: Mathworks Resources



Mathworks team will give a tutorial after my talk





IFEC 2024: Technical Objective

Topic: Stereo Switch-mode Audio Power Amplifier

- Power input: 48 V from dc supply
- Audio output: 135 W per channel, 3 channels
- Signal Input: Balanced analog stereo





IFEC 2024: Vision Statement for Competition

An emphasis on converter and control innovations:

 An ideal design would have an innovative power stage, high-bandwidth closed-loop performance, a modestsized output filter, and sound exceptional to an audio professional.







The closed-loop power electronics system:





























Goal is for output waveforms to track analog input signals. Analog and/or digital controls may be used.

























IFEC 2024: Test Equipment

Audio Precision brand, APX5xx B Series or a similar unit

• One unit will be procured for evaluating performance during final competition.







IFEC 2024: Metrics

Metrics will include but not be limited to:

- Subjective listening experience
- Input-output audio frequency response
- THD and distortion metrics in general
- Signal-to-noise ratio
- Converter efficiency
- Converter weight
- Converter volume





IFEC 2024: Overview of Balanced Analog Inputs

- The DAC below & cables will be provided at competition
- Teams are strongly urged to use these same products



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IFEC 2024: The iFi Zen DAC V2 Unit

- DAC plugs into PC via USB & run with fixed 4.2 V_{rms} output
- Select Zen unit as audio output in computer settings
- Play digital files using any audio player



IFEC 2024: Balanced Analog Input Properties

- Balanced audio provides superior sound quality
- Each XLR provides a ground and a differential waveform
- Design power stage inputs to receive balanced waveforms



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input, right input, or even both inputs

IFEC 2024: Two Volume Control Knobs

- 1 volume knob for stereo (both left & right) outputs
- 1 volume knob for subwoofer
- Use audio scaling for volume control (e.g., logarithmic pots)



IFEC 2024: The Speakers & Crossover Filters

- Speakers shown below will be provided at competition
- These will only be used for subjective listening tests
- Build crossover filters to give speakers correct frequencies



Dali Oberon 3 Bookshelf Speaker: 6 Ohms 200 Hz and above Dum Audio, The Passive Subwoofer: 4 Ohms 20 Hz to 300 Hz



https://www.amazon.com/Dali-Oberon-Bookshelf-Speaker-Black/dp/B07H2LW93T https://dumaudio.com/products/the-subwoofer



IFEC 2024: Next Steps

- Reference WAV format audio files will be posted in early March.
- Keep up to date by checking the website regularly.
- Relevant Dates:
 - Workshop at APEC 2024

Final Competition at UT Austin

• Notification of Finalists

Feb. 25, 2024 March 08, 2024 June 16-19, 2024



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