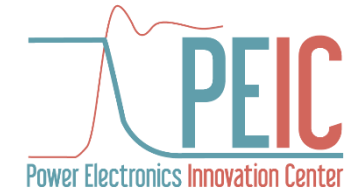




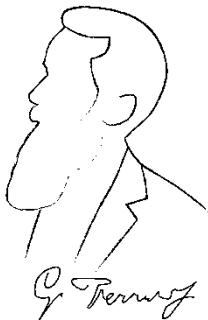
POLITECNICO
DI TORINO



Black-box Commissioning of Grid Converters

Relatore:

Prof. Radu Bojoi
Fabio Mandrile



Dipartimento Energia "Galileo Ferraris"

Politecnico di Torino, Italy

23/03/2020

Candidato:

LUCA ZEPPEGNO



Indice

- ▶ **Introduzione e obiettivo della tesi**
- ▶ **Modello del convertitore**
- ▶ **Metodo dell'iniezione di tensione**
- ▶ **Metodo dell'analisi del transitorio**
- ▶ **Conclusioni**
- ▶ **Contributi Personali**
- ▶ **Sviluppi futuri**

Introduzione

Sistemi di accumulo di energia



Caricabatterie per veicoli elettrici



Produzione fotovoltaica



Produzione eolica



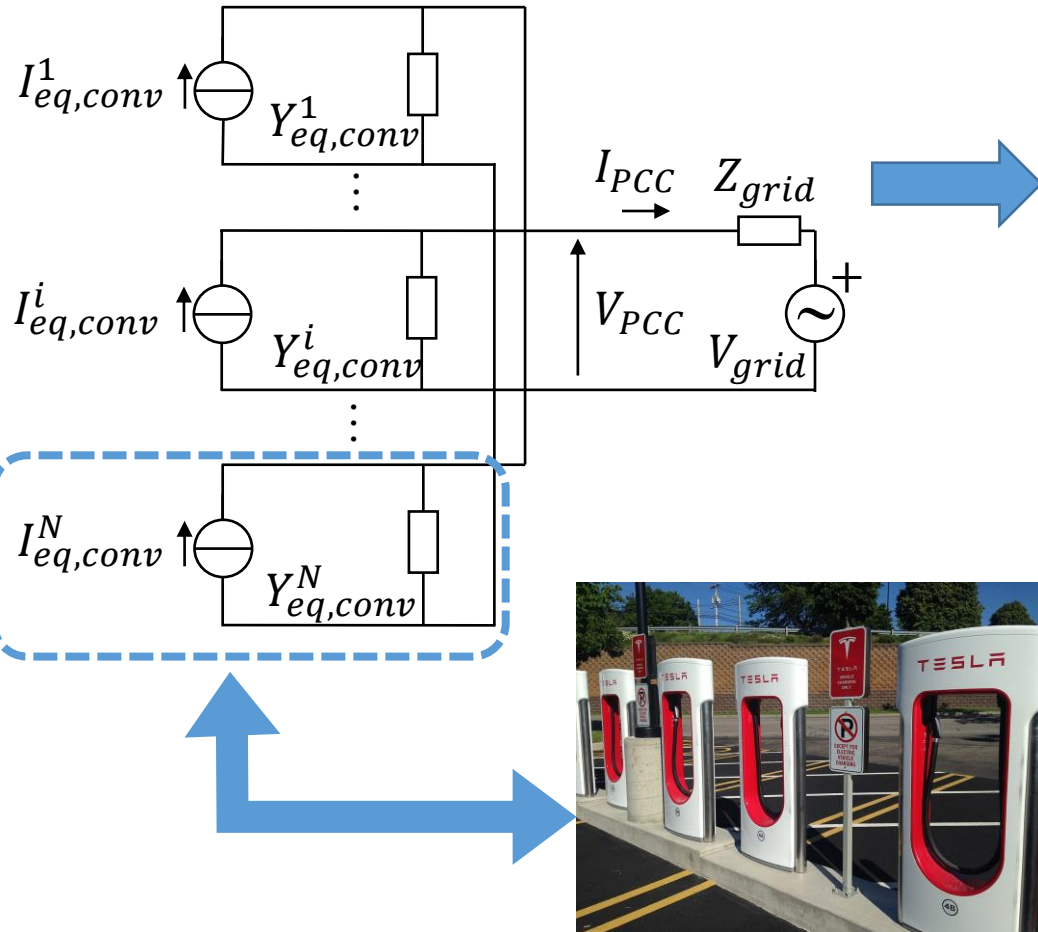
Rete Elettrica

Interazione tra più convertitori e la rete



Problemi di **instabilità armonica**

Analisi tramite
ammettenza equivalente

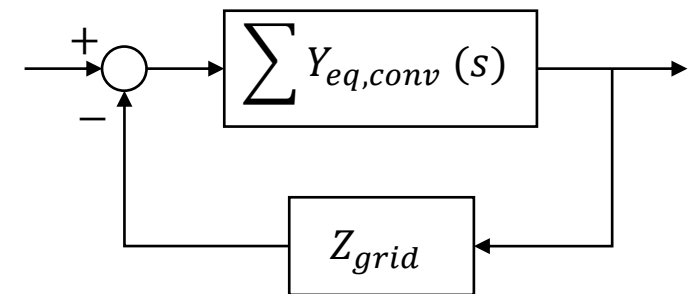


OBIETTIVO DELLA TESI

- Calcolo analitico non possibile su **convertitori commerciali**
- Non si conoscono dettagli sufficienti sul controllo

Misura sperimentale black-box

Stabilità studiata mediante **Criterio di Nyquist**



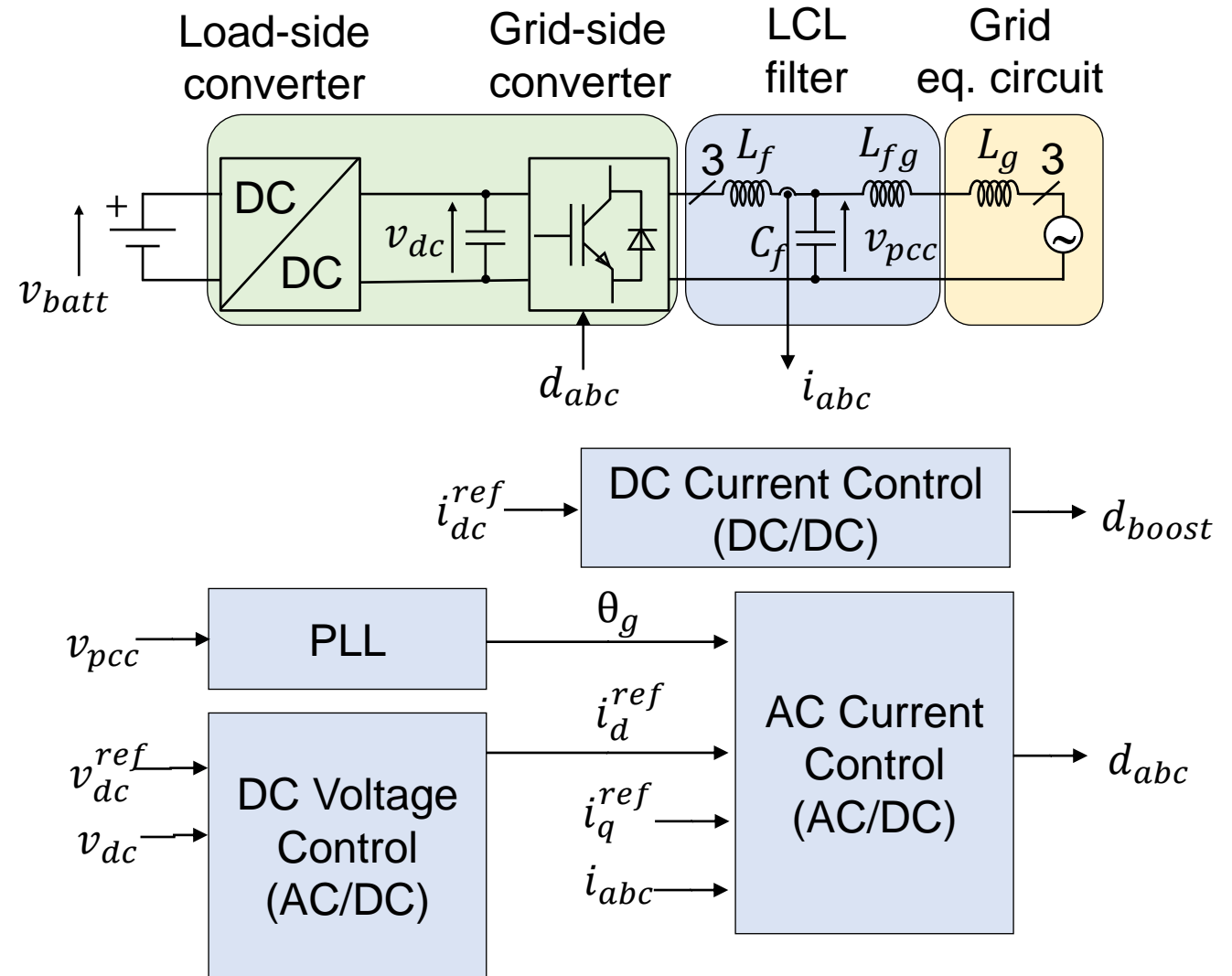
Convertitore a **due stadi**

- AC/DC: controllo in cascata di corrente AC e tensione DC in assi dq
- DC/DC: controllo di corrente

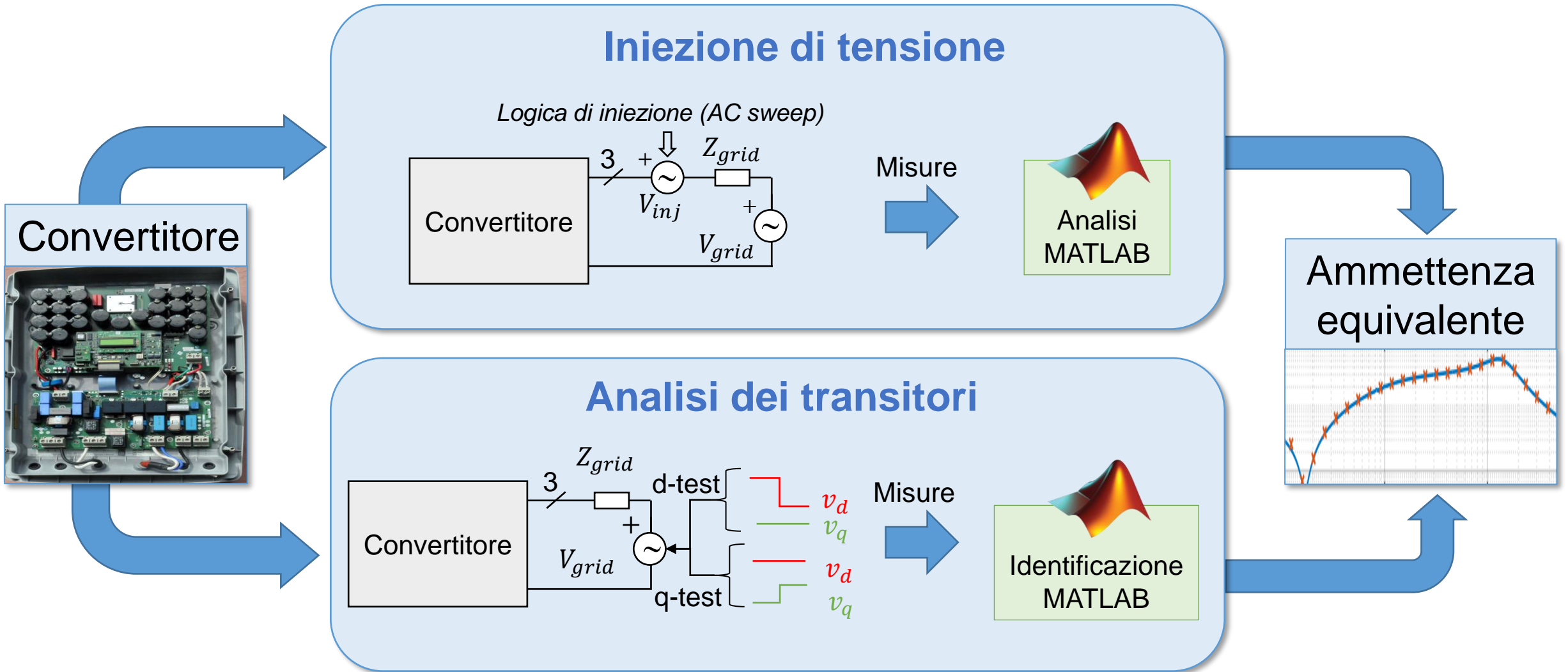


Struttura tipica per

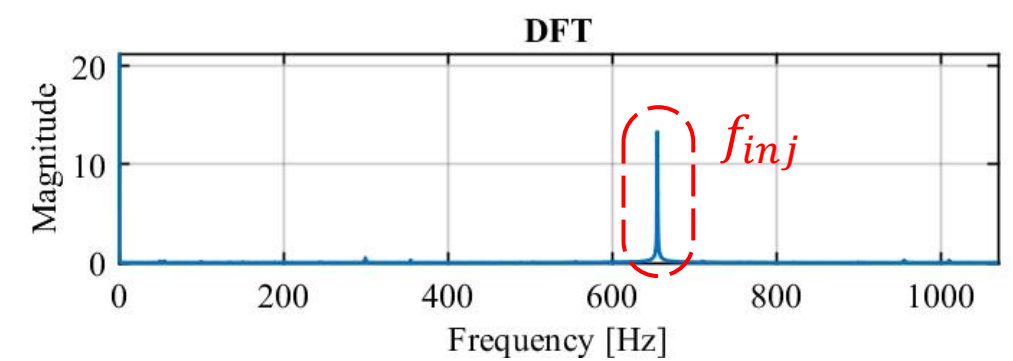
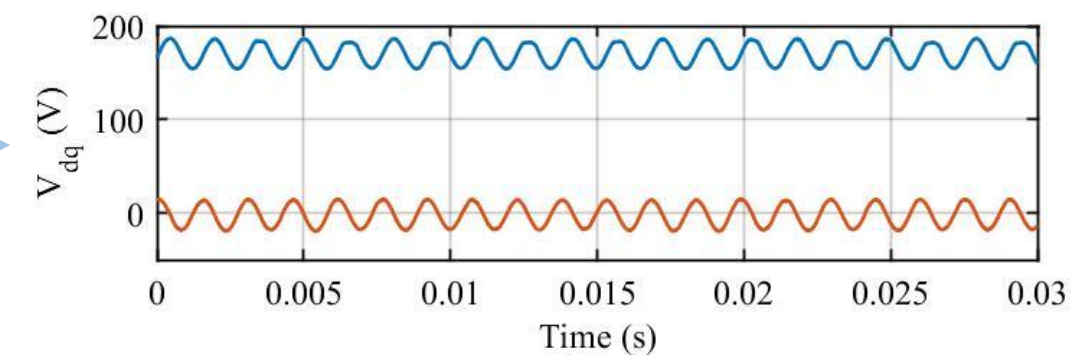
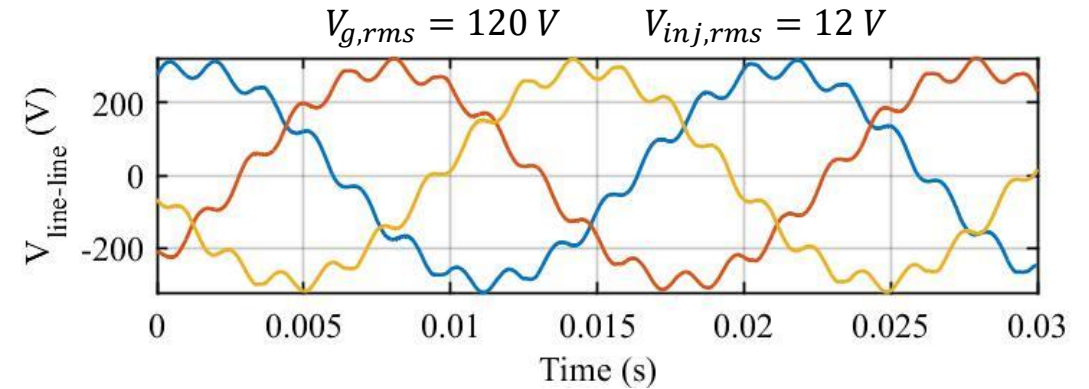
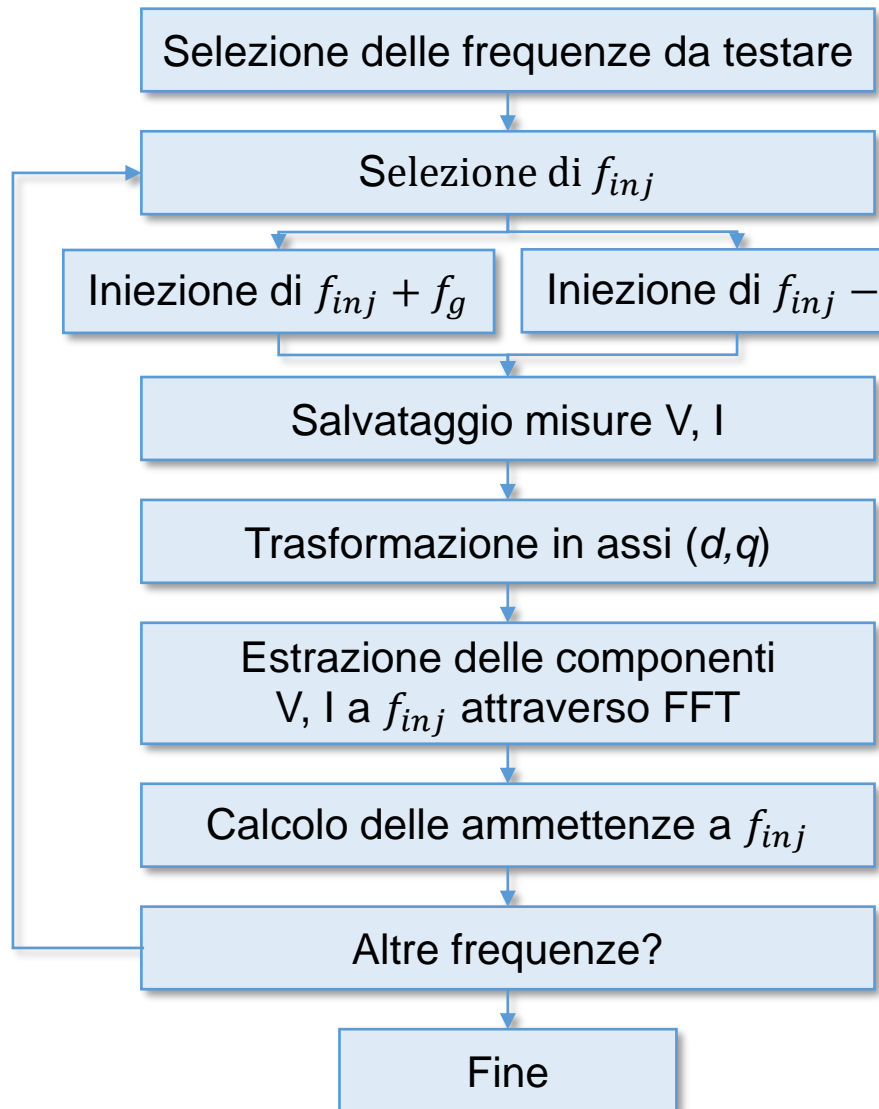
- battery chargers
- fotovoltaico



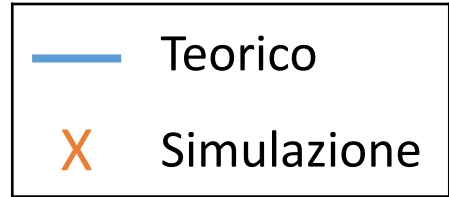
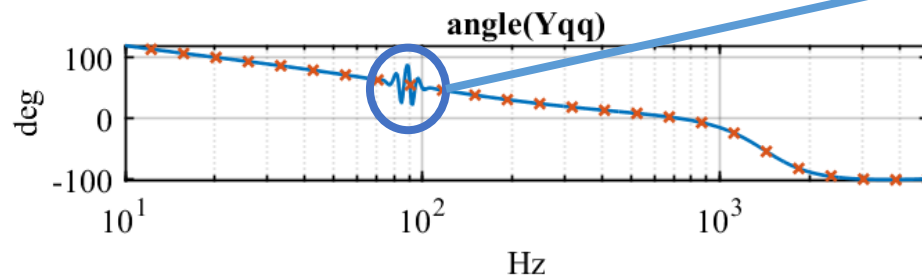
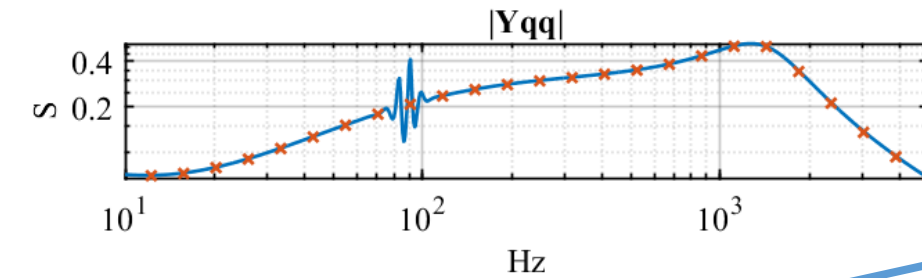
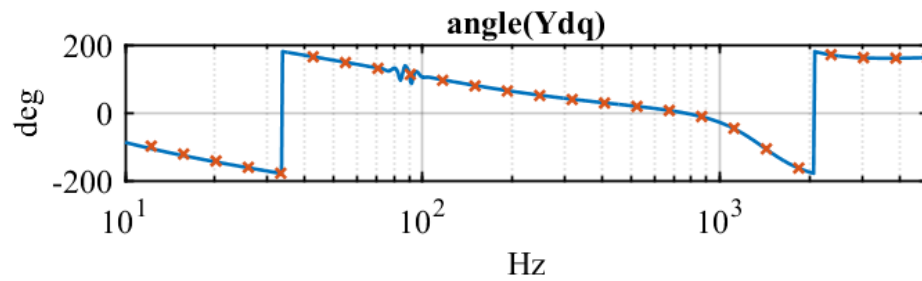
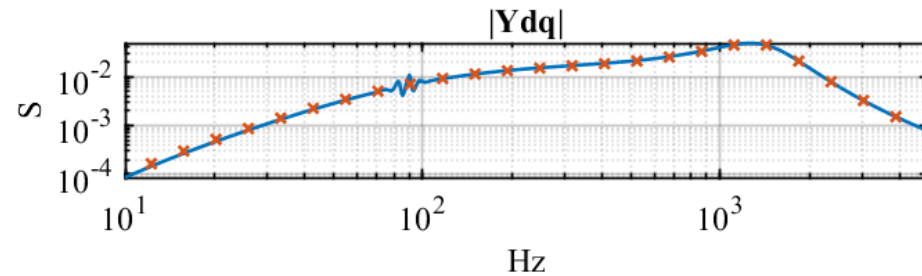
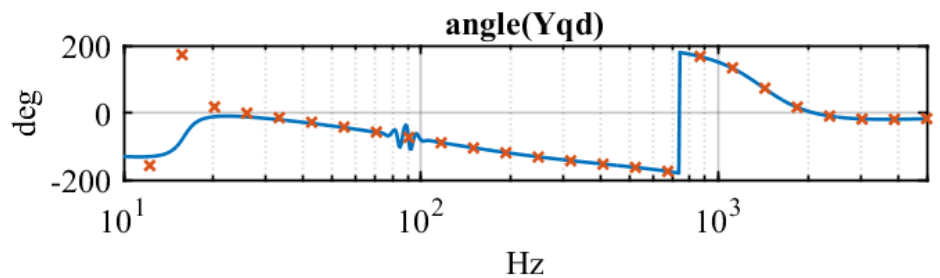
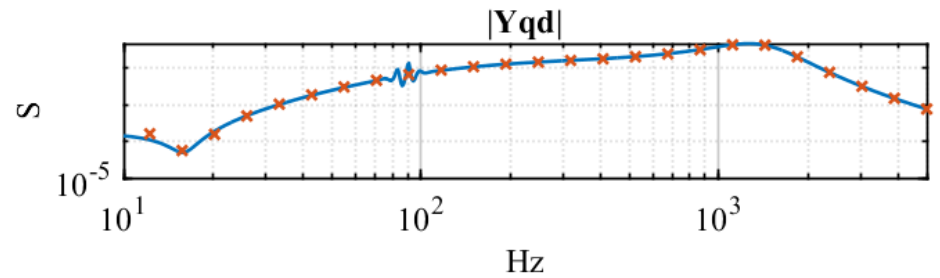
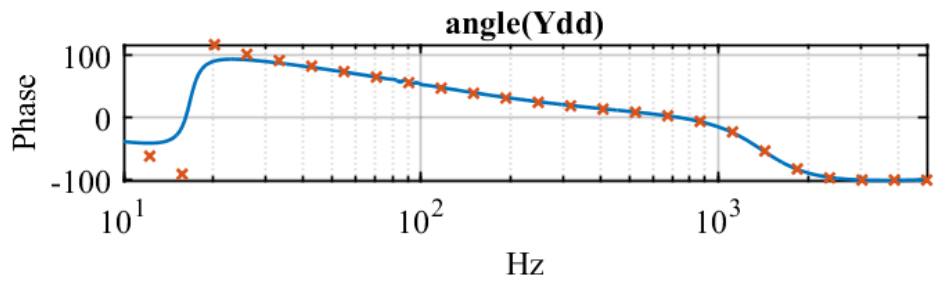
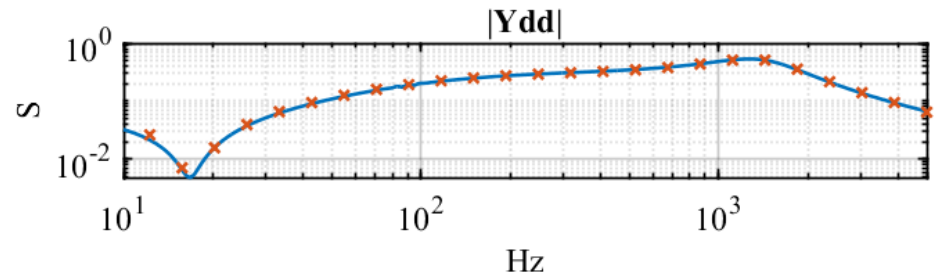
Metodi di misura sperimentale dell'ammettenza equivalente



Metodo dell'iniezione di tensione: procedura

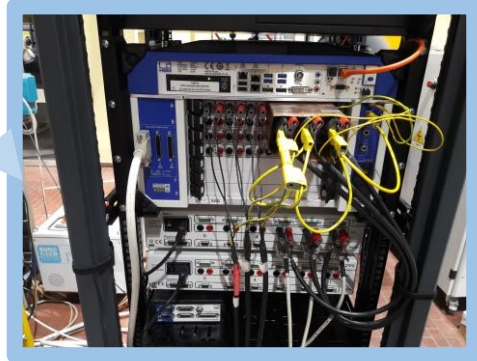
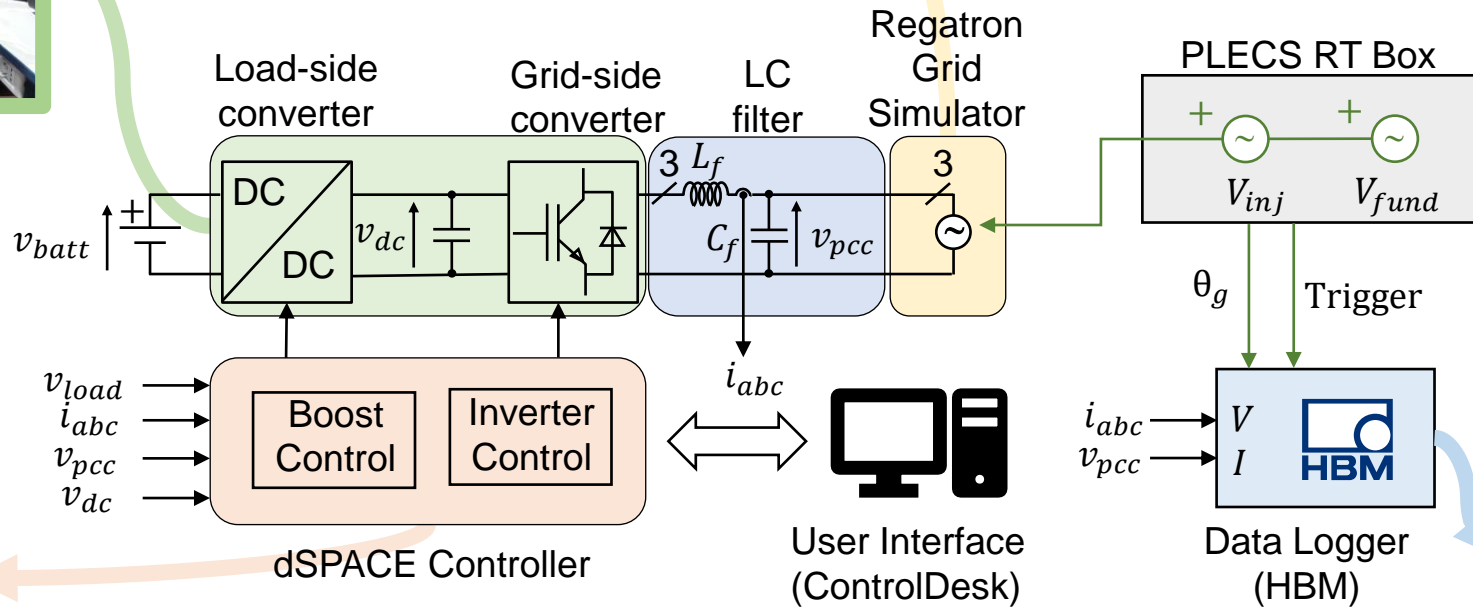
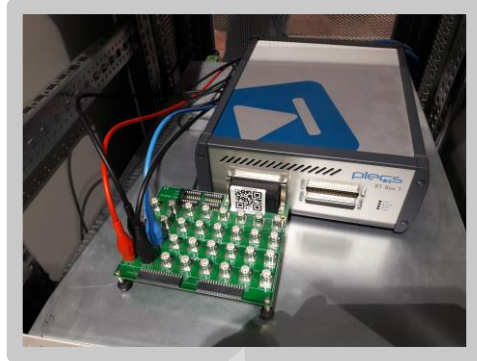
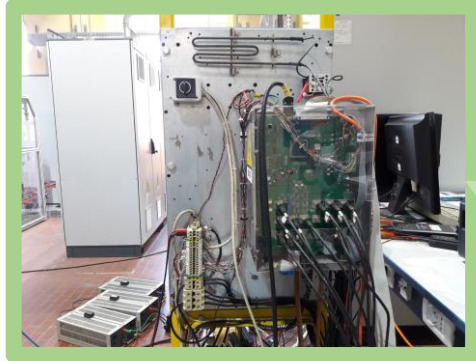


Metodo dell'iniezione di tensione: risultati in simulazione

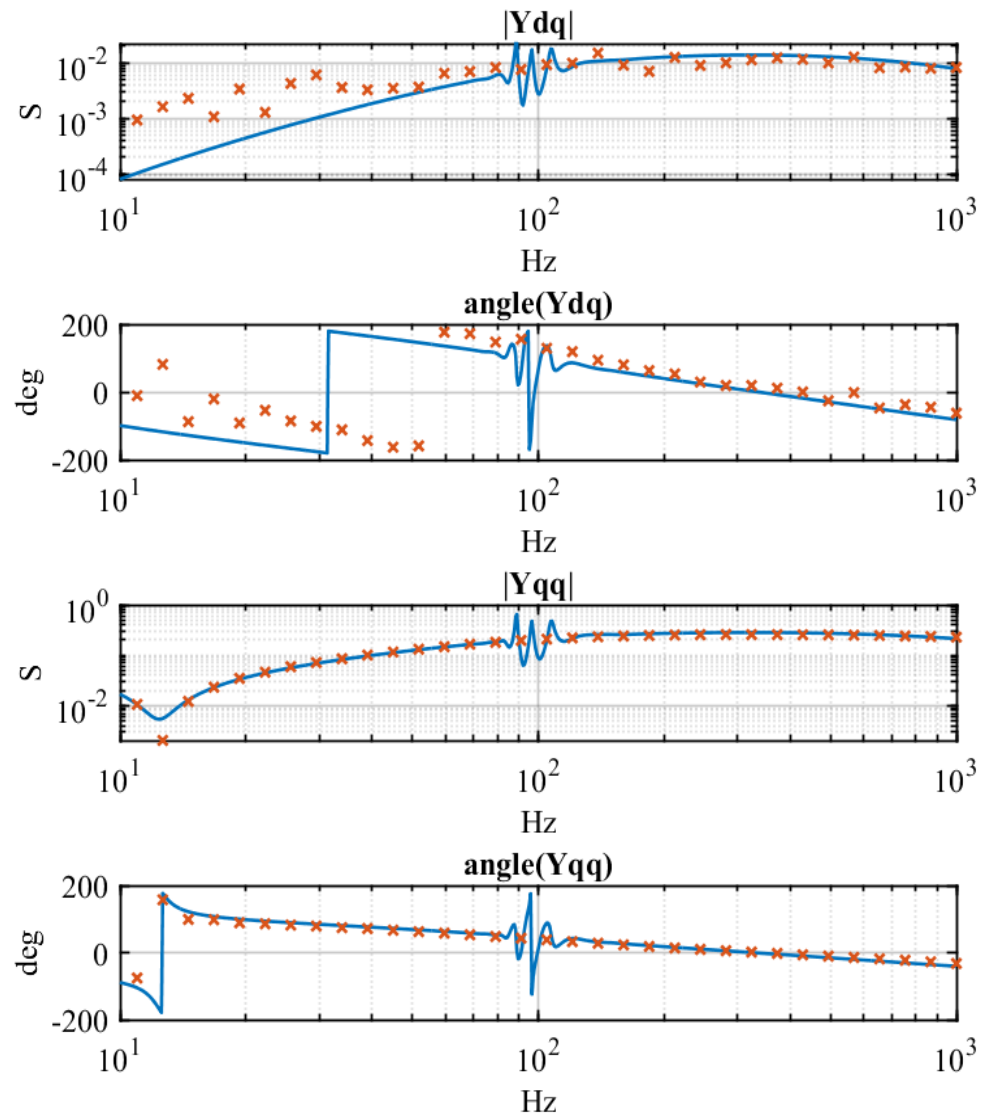
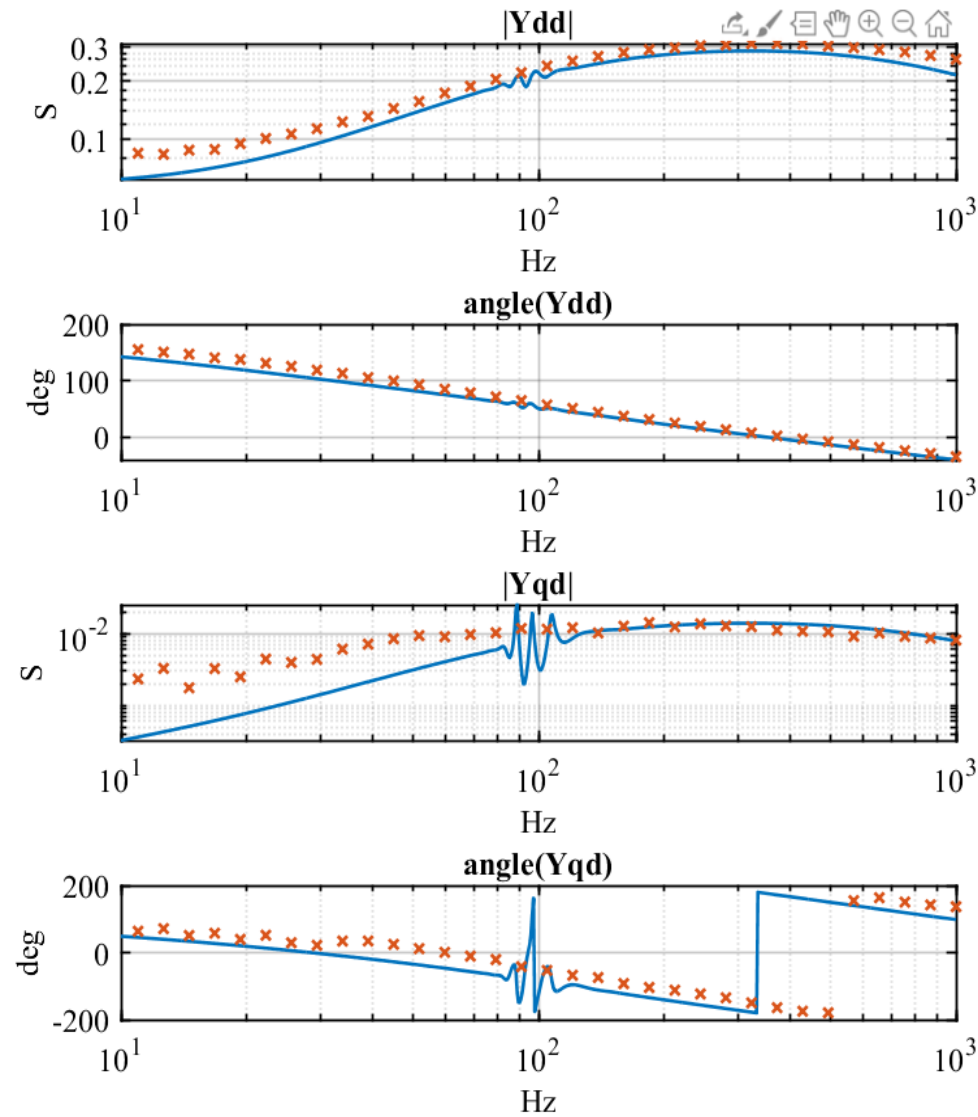


Disturbo nel risultato teorico
→ errore dovuto all'inversione delle matrici

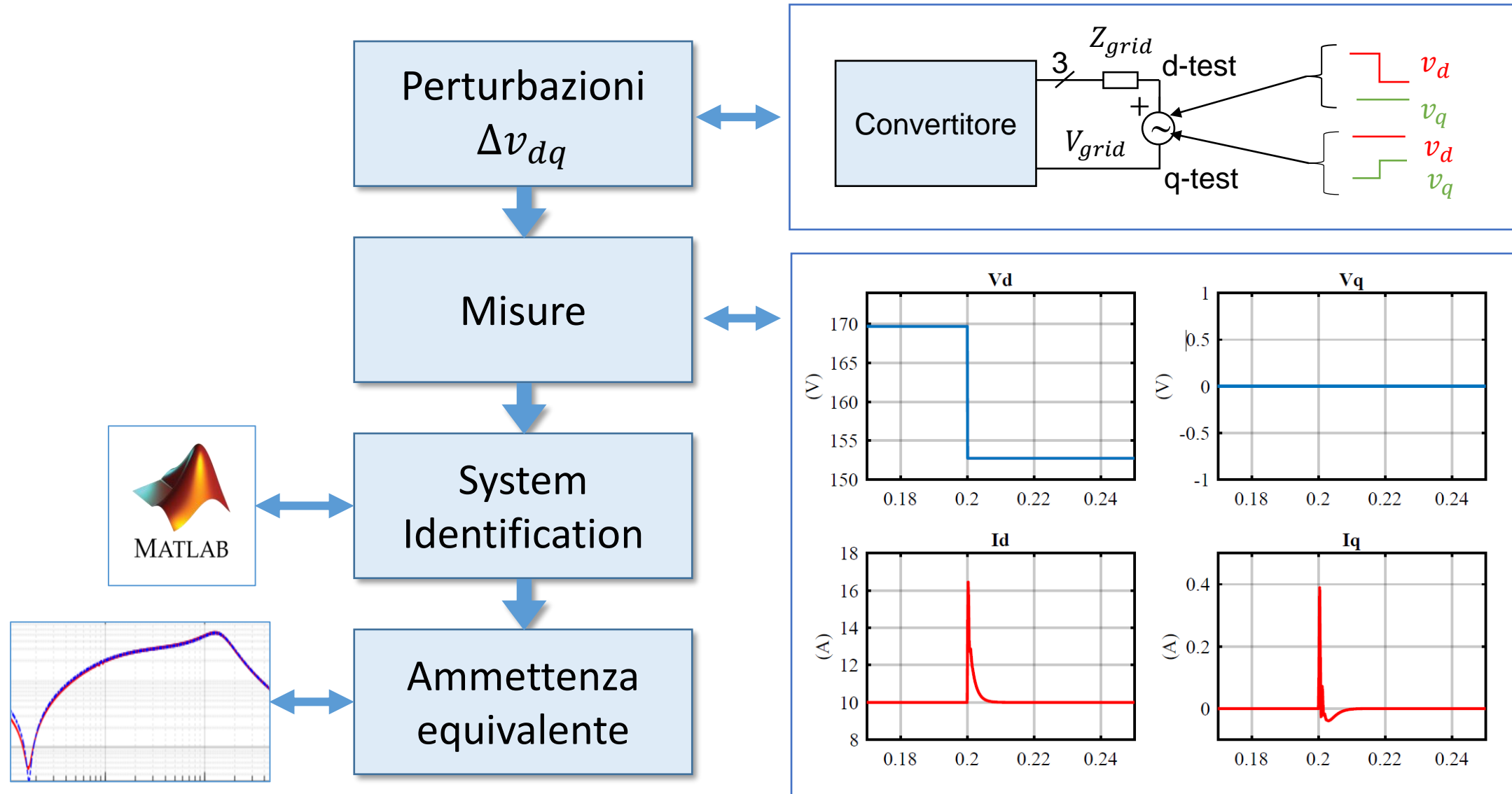
Metodo dell'iniezione di tensione: set-up sperimentale



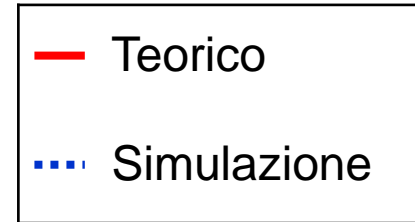
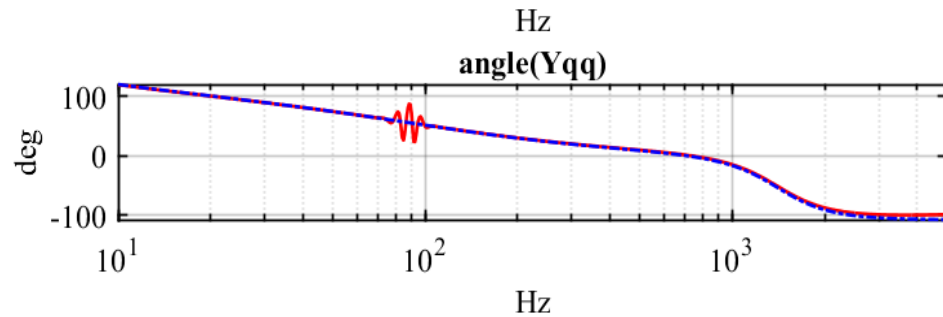
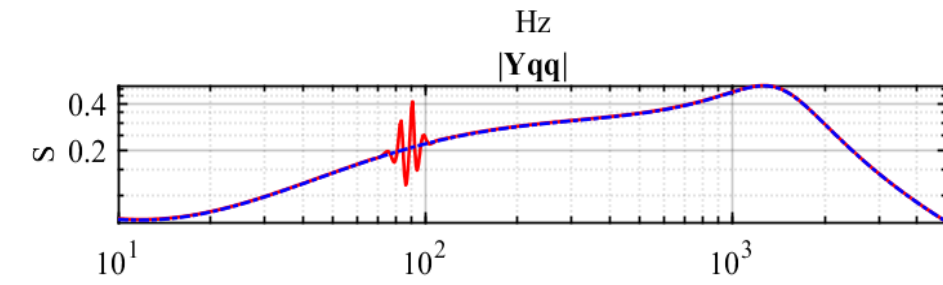
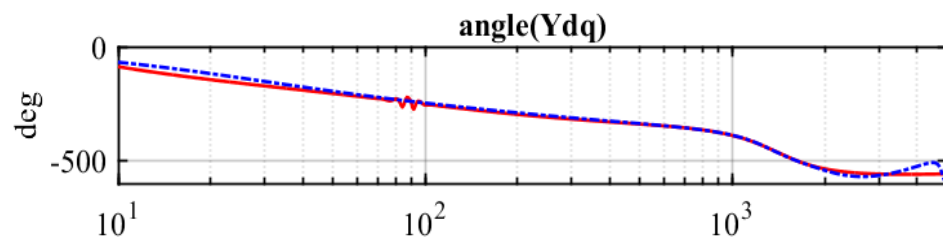
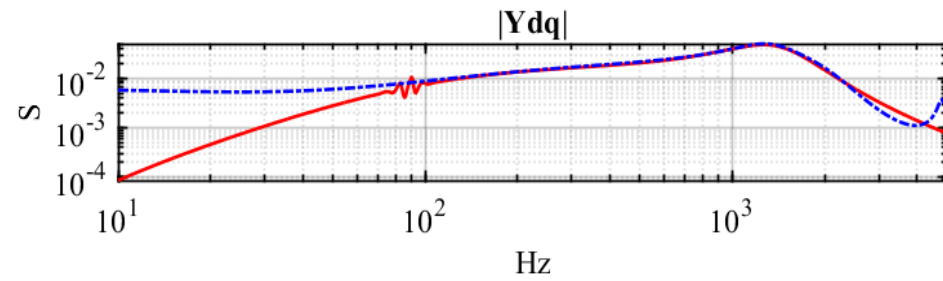
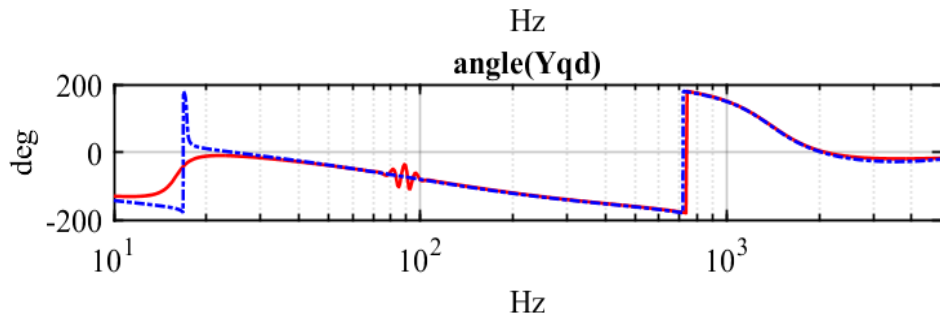
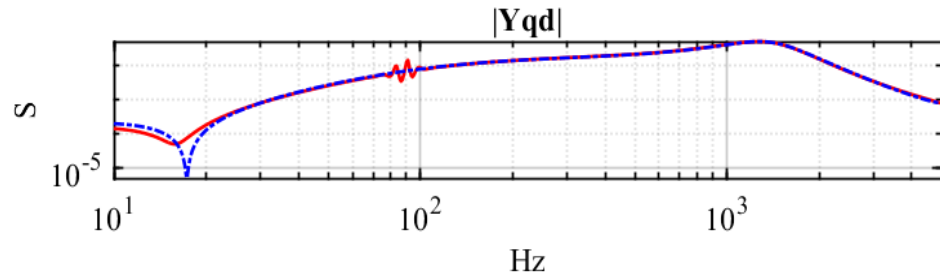
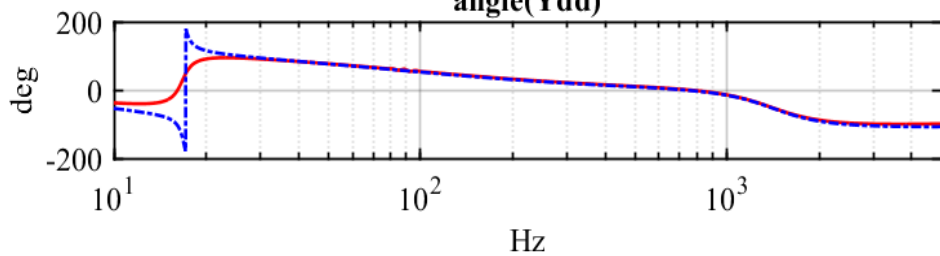
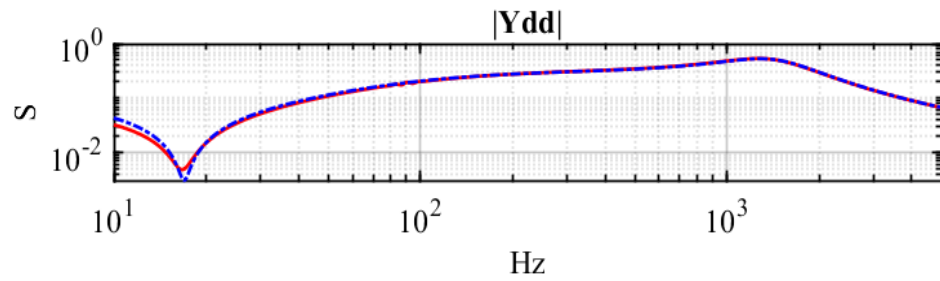
Metodo dell'iniezione di tensione: risultati sperimentali



Metodo dell'analisi del transitorio



Metodo dell'analisi del transitorio



Conclusioni

	Iniezione Tensione	Analisi transitorio
Risultati in simulazione	Molto buoni	Buoni
Risultati in laboratorio	Buoni	Da sviluppare meglio
Automatizzabile	Sì	No
Serve MATLAB?	No	Sì



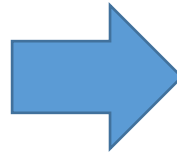
MIGLIORE!

Contributi personali

Analisi della letteratura sui metodi di misura dell'ammettanza equivalente

Studio dei metodi di **System Identification**

Implementazione di un **controllo discreto** in assi (d,q) su un convertitore trifase connesso in rete



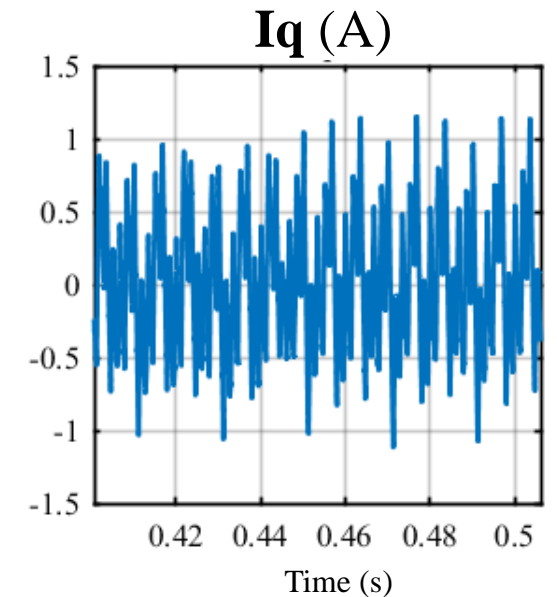
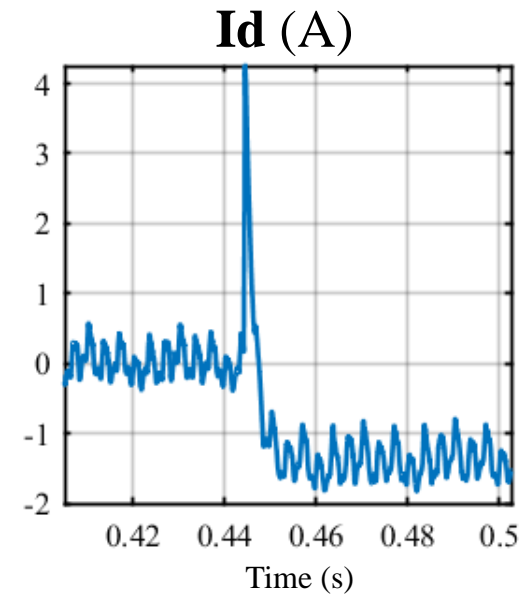
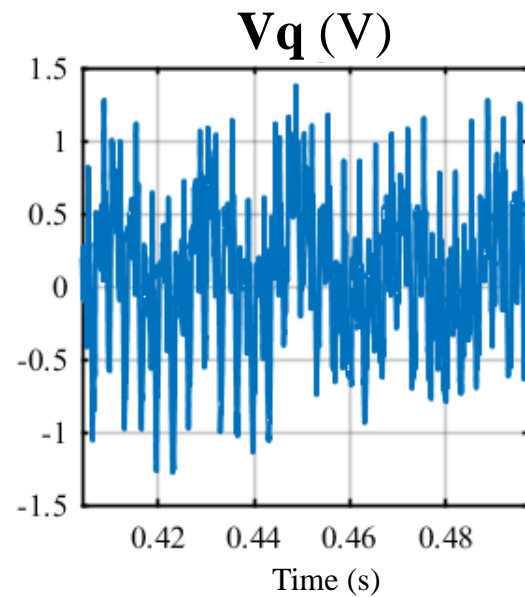
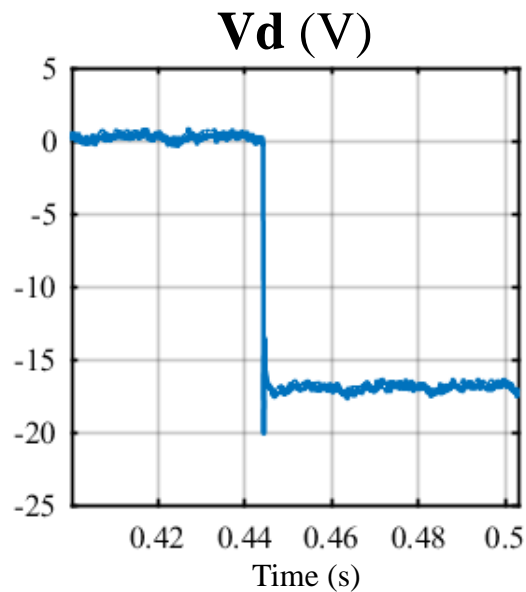
Misura dell'ammettanza equivalente tramite metodo dell'**iniezione di tensione** con:

- **simulazione**
- set-up **sperimentale**

Misura dell'ammettanza equivalente tramite metodo dell'**analisi dei transitori** con **simulazione**

Validazione **sperimentale** analisi dei **transitori**

Risultati preliminari



Grazie per l'attenzione