

### 1. Dimensioning of a STATCOM

A three-phase four wire unbalanced star-connected load ( $Z_a = 2.0 + j0.5 \text{ pu}$ ,  $Z_b = 3.0 + j1.0 \text{ pu}$  and  $Z_c = 4.0 + j1.5 \text{ pu}$ ) has an input line-to-line voltage of 690 V, 50 Hz, AC supply. Base impedance is  $1.75 \Omega$  per phase. The load should be compensated to draw only balanced active power from the AC supply using STATCOM described in the figure below.

The supply can be assumed stiff enough that the load has no effect on the voltage level. Additionally, neutral current compensation of the STATCOM can be ignored.

Calculate when the STATCOM is operating

- load and supply phase currents and load neutral current
- STATCOM phase currents
- kVA rating of the STATCOM

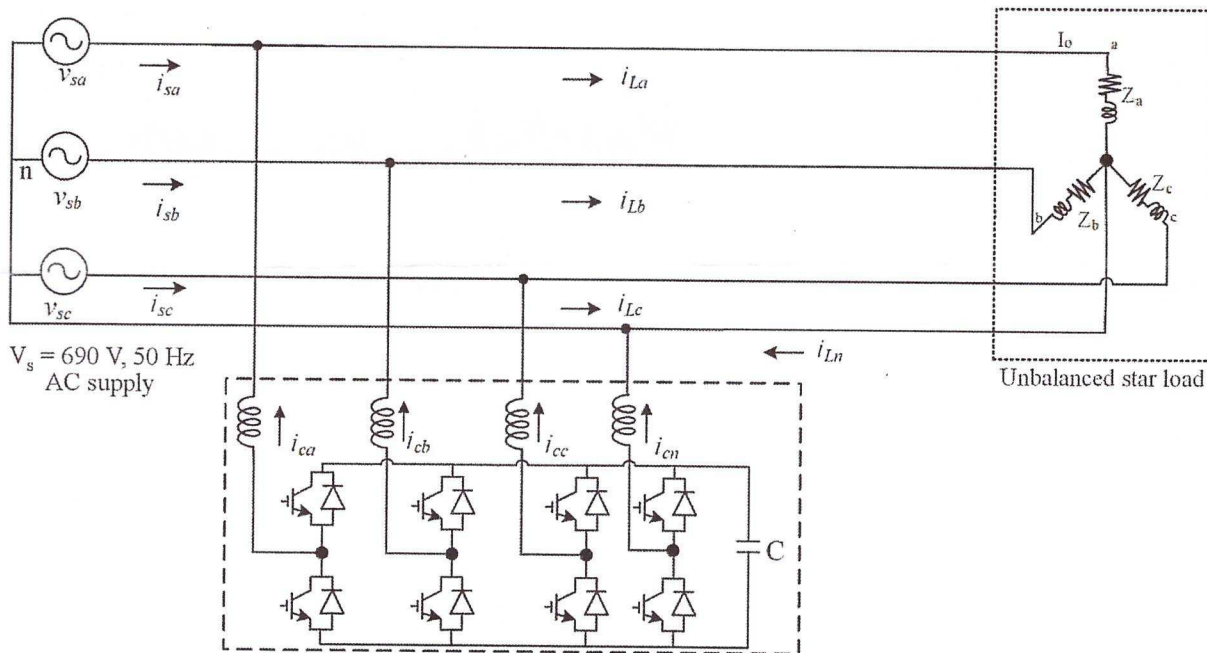


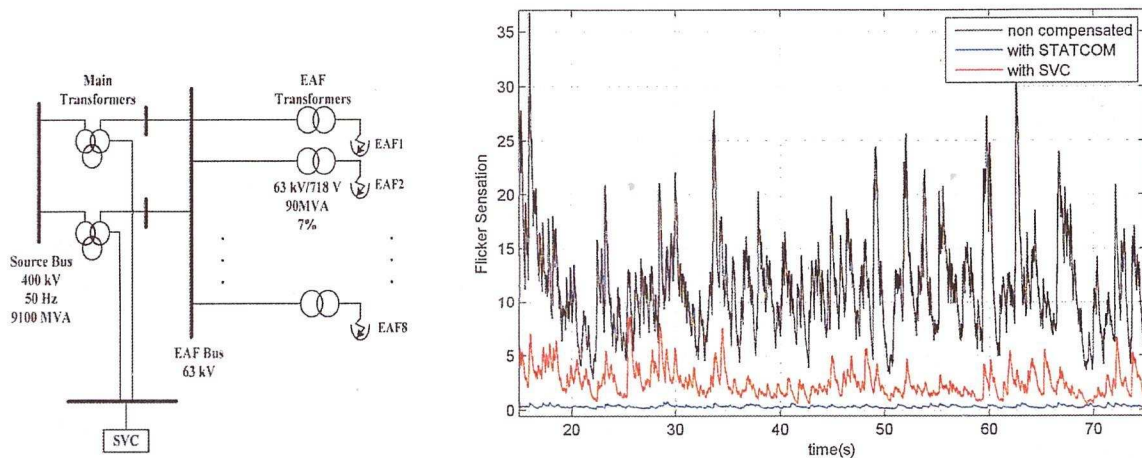
Fig. 1. Three-Phase STATCOM for compensation of unbalanced star connected load.

### 2. Active power filter (APF)

- Why shunt-connected APF is connected close to the industrial load?
- What measurements are required to control the shunt-connected APF?
- What is the operation principle of shunt-connected APF?
- What are the advantages and disadvantages of APFs compared to passive filters?
- What means hybrid active power filter?
- What means UPQC? Why UPQC is connected to the power system?

### 3. SVC

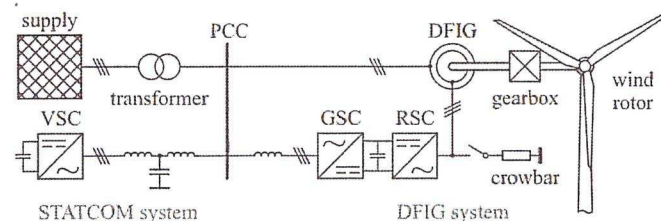
- Why SVC is connected to the system shown in Fig. 2?
- Explain the structure of SVC. What components SVC includes?
- Explain shortly the operation of an SVC.
- Why the passive compensation circuit is added as a part of SVC installation?
- Would it be possible to use passive compensation instead of SVC in the case show in Fig. 2? Explain why.
- Why better results are obtained by using STATCOM instead of SVC in Fig. 2?



**Fig 2.** SVC with electric arc furnace (EAF) in Mobarakeh steel company  
(<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7827763>)

### 4. STATCOM

- Why STATCOM is connected to PCC of the wind park as shown in Fig. 3?
- Explain shortly the operation principle of STATCOM.
- What is a modular multilevel converter (MMC) and why are they used e.g. in high power STATCOMs? What disadvantages do MMCs have?
- What are the advantages and disadvantages of STATCOM compared to SVC?
- What means STATCOM with energy storage (ESTATCOM)?



**Fig 3.** STATCOM with wind park  
(<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8216443>)