

# An efficient electro mechanical coupling of Parallel hybrid system using SCADA

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## ABSTRACT

*This paper presents the literature review of vibration characteristics under different operating conditions of Engine, Motor and hydraulic pump. Compared with stable drive cycle of automobile the load of construction machinery changes frequently & drastically. Each component must be adjusted to match the changing load. The Electro mechanical coupling is very important in construction machinery. The existence of motor changes the dynamics of the system compared with the pure engine drive. The control mechanism is based on supervisory control And Data acquisition. This control strategy gives out the control signal of Engine, Motor and hydraulic Pump.*

## INTRODUCTION:

In the automotive industry, electrical and electromechanical components and systems become more and more important. In comparison with commonly used mechanical and hydraulic systems they offer a large number of advantages with respect to efficiency and flexibility. For example, therefore, conventional hydraulic steering systems are being replaced more and more with electro mechanical ones. Currently, different concepts of electromechanical steering systems are being developed.

## LITERATURE REVIEW:

In order to study the vibration of the hybrid power system, an electro-mechanical coupling dynamics test-bed is put forward.

The study can provide reference for optimization design and vibration control. This paper presents the control strategy of the system. And the control system will be described in detail.

## TEST-BED DESIGN SELECT

There are three kinds of hybrid power system: series connection, parallel connection and mixed connection. In series connection, the mechanic energy output by the engine is changed to electric energy by electric generator. And the electric energy transmits to the motor to driven the load. The main advantage is that the engine remains working at a high efficiency and low emission point. But there are two main disadvantages ( i) the efficiency is low because of too much energy convert;( ii) the

cost is high because of large electric generator and motor.

In parallel connection, load can be driven by engine and motor together or separately. The battery can absorb the redundant energy of the engine and supply the energy shortage. In mixed connection, one part of the output energy of the engine is driven the load directly and the other part is changed into electric energy to be stored in the battery or transmit to the motor. It shows the advantages of series connection and parallel connection. Too many components, complicated layout and control are disadvantages. The research shows that the parallel connection is the best one .

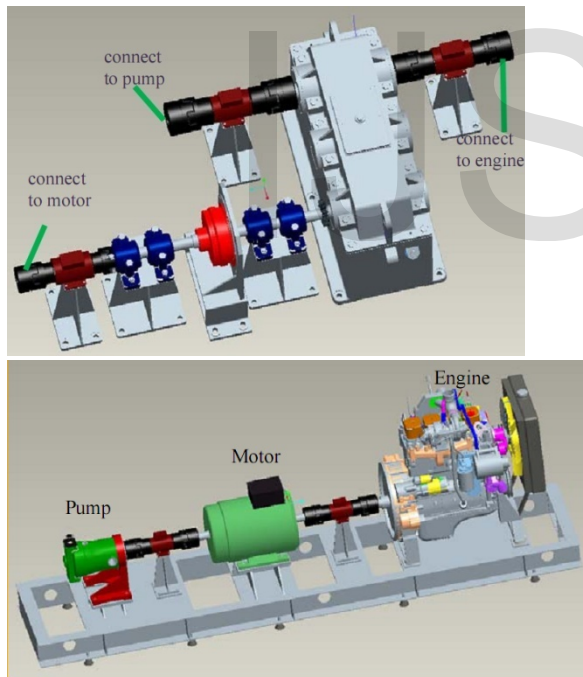


Figure 1: Schematics of gear design

Figure 2: Schematics of conjunct shaft design

### CONTROL STRATEGY:

There are two basic principles of the control strategy of hybrid power system :

1. Drive is the highest priority. The torque of the engine and the motor should be enough to satisfy the load.
2. The engine should work at the high efficiency and low emission point. In parallel connection, the engine is the main power supply and the motor is the auxiliary one. The control strategy must make sure that the engine work at the proper point with the help of the motor.

According to the two basic principles listed above, the control strategy based on torque control is selected. The torque of the engine and the motor are determined on the basis of the load. And the control targets are high efficiency, low emission and low vibration. The main difficulties are torque distribution and vibration control. So two sets of tests must be carried out:

1. The load is fixed. The energy consume including diesel and electric and vibration are tested under different torque distribution ratio of the engine and the motor. One set of tests under a certain load are carried out. Finally, the best torque distribution ratio under a certain load is selected according to energy consume and vibration.
2. The engine works at the fixed point which can supply the average load. When the engine power is not enough, the motor makes up the shortage. Otherwise, the engine drives the motor to generate electric. The control of motor should be studied to reduce the vibration shock during motor connect, speed regulation and disconnect.

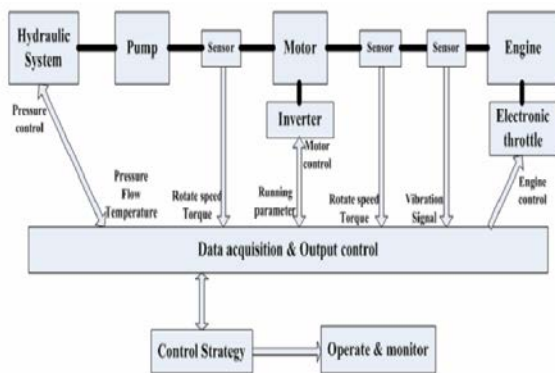


Figure 3:  
 Schematics of control system

## PROPOSED MODEL

The main aim of this paper is to control the vibration of machines and to control other parameters such as, motor speed, engine speed, torque, oil flow & level, temperature and pressure. The Controlling mechanism is based on SCADA..

### SCADA:

- SCADA is used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control, energy, oil and gas refining and transportation.
- A SCADA system gathers information, transfers the information back to a central site, then alerts the home station that a leak has occurred, carrying out necessary analysis and control, such as determining if the leak is critical,

and displaying the information in a logical and organized fashion.

- These systems can be relatively simple, such as one that monitors environmental conditions of a small office building, or very complex, such as a system that monitors all the activity in a nuclear power plant or the activity of a municipal water system.
- Traditionally, SCADA systems have made use of the Public Switched Network (PSN) for monitoring purposes. Today many systems are monitored using the infrastructure of the corporate Local Area Network (LAN)/Wide Area Network (WAN). Wireless technologies are now being widely deployed for purposes of monitoring.

### SCADA systems consist of:

- One or more field data interface devices, usually RTUs, or PLCs, which interface to field sensing devices and local control switchboxes and valve actuators
- A communications system used to transfer data between field data interface devices and control units and the computers in the SCADA central host. The system can be radio, telephone, cable, satellite, etc., or any combination of these.
- A central host computer server or servers (sometimes called a SCADA Center, master station, or Master Terminal Unit (MTU))
- A collection of standard and/or custom software [sometimes called

Human Machine Interface (HMI) software or Man Machine Interface (MMI) software] systems used to provide the SCADA central host and operator terminal application, support the communications system, and monitor and control remotely located field data interface devices

SCADA systems have made substantial progress over the recent years in terms of functionality, scalability, performance and openness such that they are an alternative to in house development even for very demanding and complex control systems as those of physics experiments.

### Types of SCADA

1. D+R+N (Development +Run + Networking)
2. R+N (Run +Networking)
3. Factory focus

### Features of SCADA

1. Dynamic process Graphic
2. Alarm summery
3. Alarm history
4. Real time trend
5. Historical time trend
6. Security (Application Security)
7. Data base connectivity
8. Device connectivity
9. Scripts
10. Recipe management

### Manufacture of SCADA

1. Modicon (Telemecanique) Visual look
2. Allen Bradly : RS View
3. Siemens: win cc
4. Gefanc:
5. KPIT : ASTRA
6. Intelution : Aspic
7. Wonderware : Intouch

### INTOUCH GOES BEYOND THE ORDINARY HMI

1. company-wonderware
2. Software-intouch
3. Version-9.5
4. Programming language-assembly language
5. 2D animation property
6. Windows- Main window
  - i. Display window
  - ii. Alarm window
  - iii. Trend window

### BASICS OF VIBRATION DYNAMICS:

Vibrations are mechanical oscillations about an equilibrium position. There are cases when vibrations are desirable, such as in certain types of machine tools or production lines. Most of the time, however, the vibration of mechanical systems is undesirable as it wastes energy, reduces efficiency and may be harmful or even dangerous.

### VIBRATION ANALYSIS

Industrial vibration analysis is a measurement tool used to identify, predict, and prevent failures in rotating machinery. Implementing vibration analysis on the machines will improve the reliability of the

machines and lead to better machine efficiency and reduced down time eliminating mechanical or electrical failures. Vibration analysis programs are used throughout industry worldwide to identify faults in machinery, plan machinery repairs, and keeps machinery functioning for as long as possible without failure.

**MACHINES:**

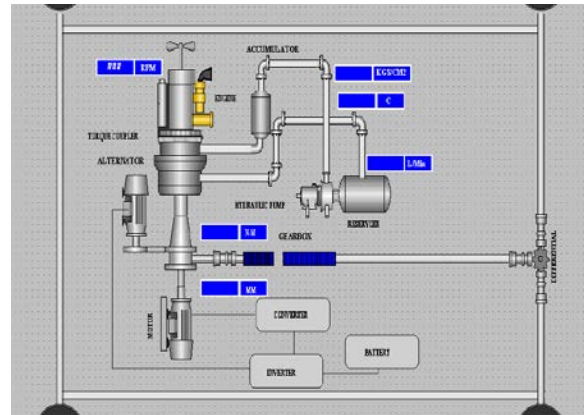
Typical machines include motors, pumps, fans, gear boxes, compressors, turbines, conveyors, rollers, engines, and machine tools that have rotational elements.



Fig:-Measuring Motor Bearing Vibration

The rotating elements of these machines generate vibrations at specific frequencies that identify the rotating elements. The amplitude of the vibration indicates the performance or quality of machine. An increase in the vibration amplitude is a direct result of failing rotational elements such as bearings or gears. Based on the machine speed, the rotational frequencies can be calculated and compared to the measurements to identify the failure mode.

**PROJECT MODEL:**



Overall circuit-Main window

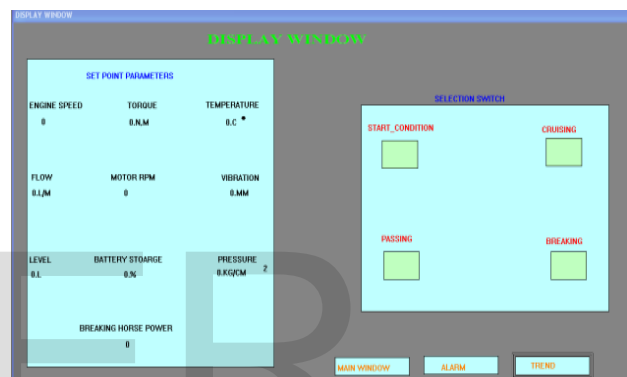


Fig:-Display window

ALARM

Date	Time	Status	Class	Type	Priority	Notes	Group	Parameter	Value	Limit
21-Dec	21:38	ACT_PFN	VALVE	H	1	YIB	Hydraulic	VALVE	140.0	150
21-Dec	21:38	TRUCK	VALVE	H	1	YIB	Hydraulic	VALVE	140.0	150
21-Dec	21:38	ACT_PFN	VALVE	LO	1	YIB	Hydraulic	VALVE	100.0	100
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21-Dec	21:38	ACT_PFN	VALVE	H	1	YIB	Hydraulic	VALVE	140.0	150
21-Dec	21:38	TRUCK	VALVE	H	1	YIB				





and Data Acquisition Control. The Software used is Wonderware-intouch 9.5v.

The torque control is selected as the control strategy and the control targets are high efficiency, low emission and low vibration. The engine should work at the predetermined high efficiency and low emission zone. And the proper torque distribution ratio and motor control algorithm should be reached.

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