A Tri-Axial Accelerometer Interface For The Transmission Of Impact Measurements

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General Athletic Accelerometer Applications

Figure 3 [3]: Rowing Application

Figure 4 [4]: Hockey Application
The Accelerometer

• What is an accelerometer?

• Defining Characteristics
  – ‘g’-rating
  – sensitivity
  – axes

• Choosing the proper accelerometer
  Entran Devices [5]
  EGA Miniature Accelerometers
  (3.56 x 3.56mm to 12.7 x 12.7mm)
The Evaluation Board

\[ A(g) = \frac{T_1}{T_2} - 0.5 \times 12.5\% \]

Duty Cycle

Period

Noise (rms)

\[ F(3\text{dB}) = \frac{1}{(2 \times 32k\Omega) \times C(2,3)} \]

C(2,3)
Accelerometer Data Evaluation

Experimental Setup

'\text{A}' indicates the release point of the pendulum
'
\text{B}' indicates the point of the first impact with the wall
'
\text{C}' indicates the point of the second impact with the wall
'
\text{D}' indicates the point of the third impact with the wall
'
\text{E}' indicates the pendulum's recoil period

67 Degree Pendulum Swing

67 Degree Impact
Accelerometer Data Evaluation (cont.)

[Graphs showing accelerometer data readings for different calibrations and accelerations.]
## Display Mechanism

<table>
<thead>
<tr>
<th>Display</th>
<th>Acceleration Range (g’s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 to .25</td>
</tr>
<tr>
<td>0*</td>
<td>.25 to .75</td>
</tr>
<tr>
<td>0**</td>
<td>.75 to 1.25</td>
</tr>
<tr>
<td>“</td>
<td>“</td>
</tr>
<tr>
<td>0**********</td>
<td>9.75 to 10.25</td>
</tr>
<tr>
<td>Overload</td>
<td>&gt; 10.25</td>
</tr>
</tbody>
</table>
Transmission & Reception

Linx Technologies LC Series Wireless Data Modules

315 Hz Transmitter: 315 Hz Receiver:

Benefits:
• low cost
• low power consumption
• very compact
Other Transmission Considerations

• Choosing an Antenna

  The “Splatch”
  0.062” thick (easily concealed)

• Data Encoding

  The Scenix Microcontroller
Transmission/Reception Eval Boards

Scenix Programmer:
In from PC (Sxkey)

RF in (ant)

Data out from receiver, into microcontroller

Vcc
GND

Vcc
GND

Vcc
GND

Scenix Programmer:
Out to PC

50MHz Clock

GND

Vcc
Transmitting the #1:

**ACCEL** → **PIC**

**PIC** receives data acquisition and RS232 communication

**TX** (transmit) and **RX** (receive) perform the conversion from series to parallel

**PIC** converts the output to:

1010010111111001 (x-accel)
1010010100011001 (y-accel)

Transmitting the #1:

Transmitting the x-zeroing value (42265) and the y-zeroing value (42489)

The four byte serial output to be sent is:

1010010111111001 (x-accel) 1010010100011001 (y-accel).
Conclusions

• Preliminary filtering, scaling, & display mechanisms completed

• LC Series transmitter and receiver of sufficient caliber

• Transmission board capable of sending RS232 data across RF link

• Reception board capable of converting series to parallel

• Link must be established between the transmitter and receiver
Accelerometer applications within impact monitoring systems are numerous. I believe the future of this device lies in the development of wireless interface system compatible with each of the applicable environments - a universal accelerometer interface requiring only minor alterations when switching from one application to the next.
References