Re: measuring distance between two cars using infrared circuits

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From: Mac (*foo_at_bar.net*)
Date: 01/24/05

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Date: Mon, 24 Jan 2005 00:09:10 GMT
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On Sun, 23 Jan 2005 14:07:55 −0500, keith wrote:

> On Sun, 23 Jan 2005 17:51:45 +0000, Mac wrote:
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>> On Sat, 22 Jan 2005 23:41:45 −0500, keith wrote:
>>
>>> On Sat, 22 Jan 2005 07:32:19 +0000, Mac wrote:
>>>
>>>> On Fri, 21 Jan 2005 04:24:38 −0800, Andrew Holme wrote:
>>>>
>>>>>
>>>>> gaurav.patil@gmail.com wrote:
>>>>>> hello,
>>>>>> i want to construct a circuit which will be able to measure distance
>>>>>> between two moving cars.The two cars are needed to maintain a fixed
>>>>>> distance between each other.
>>>>>> if the distance between them increases or decreases the circuit
>>>>>> should be able to detect this change and notify the amount of change
>>>>>> in the distance to both cars.
>>>>>> i want to construct this circuit using infrared LEDS ,so if any one
>>>>>> can help me out with this(circuit idea) please mail it to me .
>>>>>
>>>>> It might be easier with microwaves than infra−red:
>>>>>
>>>>> Measure relative velocity using the Doppler effect. By integrating
>>>>> this, you get a running estimate of the change in distance. Weird
>>>>> things might happen when you go around corners!
>>>>>
>>>>> Unfortunately, absolute measurement of short distances using
>>>>> electromagnetic waves is difficult / impossible due to the speed of
>>>>> light.
>>>>
>>>> It is not difficult at all. It just requires bandwidth. Before anybody
>>>> jumps on my case about detecting short CW pulses, let me point out that
>>>> short CW pulses have a LOT of bandwidth, and the shorter they are the more
>>>> bandwidth they have.

>>>
>>> Ok, what's the bandwidth of a kHz modulated ~2GHz carrier (wherever there
>>> is some free bandwidth). It should be trivial to measure the round−trip
>>> delay to withing a nS, which is about six inches. At a kHz,
>>> that gives us a distance measuremnt every millisecond, which should be
>>> enough for distance and differentiate to give a relative velocity
>>> number.
>>
>> Are you talking about on/off modulation of a 2GHz carrier at a 1KHz
>> rate? How long is the "on" time?
>
> Yes, pick your poision.

It looks like it doesn't really matter, anyway. The Fourier transform is
just a sum of two sinc() functions, one shifted right and one shifted left
by the carrier frequency. The pulse duration controls the magnitude of the
FT.

I believe the total bandwidth is infinite, but any finite signal has
infinite bandwidth, so that doesn't really help us.

Unfortunately, I'm not sure I know how to answer the question myself.

I'll try to remember to ask some people who might know tomorrow and get
back to you. (It also might pay to ask in the radar/sonar newsgroup.)

But the more you constrain the bandwidth, the more difficult it will be to
identify exactly where the pulse starts or stops. So for precise ranging,
you need more BW, regardless of pulse duration.

>
>>>> The same rules would apply to a modulated IR signal. There is no way the
>>>> OP is going to get any kind of high resolution ranging using IR alone
>>>> because there is just not enough bandwidth. (Some laser diodes have more
>>>> than enough bandwidth to do this, but I don't think they put out enough
>>>> power)

[snip]

>>>> Ultrasound might work well. You could have a transponder on the back
>>>> of the car in front and a range−finder on the front of the car in
>>>> back.
>>>
>>> It's *is* done without any transponder, which would make the idea
>>> useless.
>>
>> I admit that the transponder is not essential. It just makes it easier
>> to detect the signal, and increases the range over which the system
>> would work.
>
> It also adds an unknown and significant delay into the path.

Depending on exactly how the system is set up, the delay could be
completely neutralized by using a PLL.

--Mac