

```
//*****//
//
//      IRA.cpp
// Implementation file for class IRA
//*****//
//
// Author: Hui Jin
// Modification: Mar 10, 2000 First version
// This file defines the class of Irregular Repeat Accumulate code.
// the code essentially is a concatenate of LDGM code and Accumulate
code.
```

```
#include <math.h>
```

```
#include "IRA.h"
```

```
IRACode::IRACode(int info_len, int check_len, int _LEdgenum, int nv[],
degree_sequence * _pLV, degree_sequence * _pLC, \
double _sigma, RandomGenerator * _Rand, int
*_Interleaver)
```

```
{
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```
    Rand= _Rand;
```

```
    infobits_len=info_len;
    checkbits_len=check_len;
```

```
    pLV = _pLV;
    pLC = _pLC;
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```
    codebits_len = infobits_len+checkbits_len;
    rate = (infobits_len*1.0) / (codebits_len*1.0);
```

```
    LEdge_num = _LEdgenum;
    REdge_num= 2*checkbits_len-1;
```

```
    sigma=_sigma;
```

```
    y_r=new double [codebits_len];
```

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RVarNode= new var_node [checkbits_len];
LVarNode= new var_node [infobits_len];

CheckNode=new check_node [checkbits_len];

LMessage=new double [LEdge_num];
RMessage=new double [REdge_num];

Lbelief =new int [LEdge_num];
Rbelief =new int [REdge_num];

Interleaver=new int [LEdge_num];
for(int i=0; i<LEdge_num; i++) Interleaver[i]= _Interleaver[i];

getYrAWGN();

initLVNode(nv);

initRVNode();
initCNode();

initMessage();
initM0();
}

void IRAcode::initLVNode(int nv[])
{
    int deg_index=0;
    int edge_index=0;

    //for simplicity
    int edge[LEdge_num];
    for(int j=0; j< LEdge_num; j++) edge[j]=Interleaver[j];

    int i;

    int up_range= nv[0];
    for(i=0; i<infobits_len-1; i++)
    {
        //shoulbe be >=, since 0 is included.
        if(i>=up_range)
        {
            deg_index++;
        }
    }
}

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        up_range+= nv[deg_index];
    }

    LVarNode[i].init(i, pLV->d[deg_index],0);
    LVarNode[i].init_Edgeid(&edge[edge_index], pLV->d[deg_index]);
    edge_index+= pLV->d[deg_index];

}

//the last bit has to make the edge number is exactly LEdge_num;
i= infobits_len-1;
int last_deg= LEdge_num-edge_index;

LVarNode[i].init(i, last_deg, 0);
LVarNode[i].init_Edgeid(&edge[edge_index], last_deg);

// debug
// for(i=0; i<infobits_len; i++)
//     LVarNode[i].display_edgeid();
}

void IRAcode::initRVNode()
{
    int edge[REdge_num];
    for(int j=0; j<REdge_num; j++) edge[j]=j;

    int edge_index=0;
    int i;

    for(i=0; i<checkbits_len-1; i++)
    {
        RVarNode[i].init(i, 2, 1);
        RVarNode[i].init_Edgeid(&edge[edge_index], 2);
        edge_index+=2;
    }
    //the last bit has degree 1.
    i=checkbits_len-1;
    RVarNode[i].init(i, 1, 1);
    RVarNode[i].init_Edgeid(&edge[edge_index], 1);

}

void IRAcode::initM0()
{
    double r;
    int j;

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for(int i=0; i< codebits_len; i++)
{
    r=y_r[i];
    //if it belongs to the left var node.
    if(i<infobits_len)
        LVarNode[i].init_m0(r, sigma);

    else //if belongs to right.
    {
        j=i-infobits_len;
        RVarNode[j].init_m0(r, sigma);
    }
}
}

void IRAcode::initCNode()
{
    //local variables
    int j;
    int i;
    int deg_index=0;
    int edge_index=0;

    //LEFT PART, as similar to init_LVNode().
    //just take care the last node, to make edges used up in all nodes.
    /* The following main idea is, divide all the variable nodes into
        several ranges. [0, LC.fn[0]*infobits_len].
                [LC.f[0] *infobits_len,
(LC.fn[0]+LC.fn[1])*infobits_len],
                ...
        If node with id I belongs to the kth range, then it has degree
        LC.degree[k-1].
    */
    //for simplicity

    int edge[LEdge_num];
    for(j=0; j< LEdge_num; j++) edge[j]=j;

    double up_range=pLC->fn[0]* checkbits_len;
    for(i=0; i<checkbits_len-1; i++)
    {
        //in case there's zero in it.
        while(i>=floor(up_range))
        {
            deg_index++;
            up_range+= pLC->fn[deg_index]* checkbits_len;
        }
    }
}

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        (i==0) ? CheckNode[i].init(i, pLC->d[deg_index],1): \
                CheckNode[i].init(i, pLC->d[deg_index],2);

        CheckNode[i].init_LEdgeid(&edge[edge_index], pLC-
>d[deg_index]);
        edge_index+= pLC->d[deg_index];

    }
    // To make the edge number the same.
    //the last bit will have left degree LEdge_num-edge_index;
    i= checkbits_len-1;
    int last_d= LEdge_num-edge_index;

    CheckNode[i].init(i, last_d,2);
    CheckNode[i].init_LEdgeid(&edge[edge_index], last_d);

//RIGHT PART, as similar to init_RVNode();
    int r_edge[REdge_num];
    for(j=0; j< REdge_num; j++) r_edge[j]=j;

    edge_index=0;
    CheckNode[0].init_REdgeid(&r_edge[0],1);
    edge_index++;

    for(i=1; i<checkbits_len; i++)
    {
        CheckNode[i].init_REdgeid(&r_edge[edge_index], 2);
        edge_index+=2;
    }

    //debug
    // for(i=0; i<checkbits_len; i++)
    // CheckNode[i].display_edgoid();
}

void IRAcode::update_message()
{
    int i;

```

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